AMERICAN MACHINIST

November 27, 1940

Wide World

New Gun—*Brigadier General G. H. Stewart examines the new Army rifle with its inventor John C. Garand*

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ADVERTISING PAGES REMOVED

TO HELP YOU

help America

(NUMBER THREE OF A SERIES)

THE *DEFENSE PROGRAM* gains momentum. So does American Machinist's new series of special sections on armament production — written to help *you* help America. Here are typical recent comments:

"We are interested in securing ten copies of "How to Machine 75-mm. Shells."—Clyde E. Hagler, Gen. Supt., Continental Gin Company.

"It seems to me that these articles (the Armament Sections) and others yet to come are the finest materials available to put into the hands of youths . . . who are trying to plan their specialized training in order to prepare them to be wage earners . . . "—R. B. McHenry, Director, Adult & Industrial Education, Tulsa (Okla.) Public Schools.

"I would appreciate receiving copy of the Sept. 18 issue which includes several items and pictures on armor-plate castings."—W. H. Hartwig, Production Mgr., The Symington-Gould Corp.

"Please send us AMERICAN MACHINIST *for a year—and send any armament reprints that you have on how to machine shells."—Stanley W. Sparks, President, Sparks, Simplex Machinery Corp.*

"I have received copies of the Armament Sections. I find them interesting and useful."—Burton O. Lewis, Brig. Gen. U.S.A., Asst. Chief of Industrial Service Production, War Dept.

"I have held out one of these (copies of Armament Sections) for my personal use and turned the others over for distribution to interested personnel at this arsenal." —N. F. Ramsey, Col., Ord. Dept., Commander, Rock Island Arsenal.

★

Six special sections on Armament Production have already appeared. Another is in this issue. More will come in every succeeding issue of *American Machinist* — always first with the latest metal-working data. Watch for these sections — use them — they are authoritative.

WHAT'S IN THIS ISSUE

A THOUSAND A DAY

It isn't often that you run across an article like that beginning on page 969. As you may suspect from occasional hints dropped on this page, it's on the manufacture of the famous Garand semi-automatic rifle. There's been so much misinformation printed about this weapon that we know you'll be more than usually interested in our discussion of its design, performance and manufacture. It comprises virtually all of this number's Armament Section.

PICTURES FOR PERSUASION

Industrial expansion brings with it, among others, the problem of proper foreman training. At best this job is often overlooked or left to chance, but when all is confusion it is even less likely to be taken as seriously as it should. Hence we feel that a really effective improvement in foreman training technique is now particularly timely. This improvement makes use of the sound-slide film, a medium which is old stuff in the selling game but whose educational potentialities are only now being tapped. A review of developments and a report of progress to date are given by Merritt Lum on page 958.

ONE OR A MILLION

The dilemma of the shop faced with small-lot production will probably never be dispelled. But much can be eliminated simply by a fresh approach. You'd hardly think, for instance, that lots of a few dozen could be economically finished by centerless grinding. Yet such is often the case. Methods of figuring when centerless is most economical, and specific suggestions for cutting costs on small-lot runs, are given on page 960 by Robert W. Peaslee, president of Eastern Centerless Grinding Company. Eastern has been confronted with lots as small as 1 and larger than 1,000,000—just in case *you're* fretting.

ROBERT W. PEASLEE
. . . centerless only

DEAN M. WARREN
. . . light on the subject

FACTS OF LIGHT

No one would expect night production to go on unhampered with the lights off. Yet the loss in output caused by improper illumination often goes unheeded. With fluorescent lamps, even the old argument of operating cost can no longer be used as an excuse for inadequate lighting. Just what is the place of the fluorescent lamp in industry? What are the applications for which it is most suitable? What equipment is available? On page 955 Dean M. Warren, of General Electric's Nela Park Engineering Department, discusses advantages and limitations of the lighting industry's newest contribution to efficient seeing. His article includes considerable engineering data to help in estimating that particular job of yours.

STREAMLINED HINGES

Toward the end of the Armament Section, on page 984, you'll find a story on the production of piano-type hinges. These hinges are used widely in aircraft construction, and the method of making them should prove of extensive interest to all engaged in work of this type. The details are given by J. M. LaRue, of Cincinnati Shaper Company.

FINAL PASS

On page 963 we take our final pass at grinding wheels—at least for the time being. For on that page H. J. Wills, of the Carborundum Company, completes his series on dressing and truing grinding wheels. In his last installment he discusses mountings and uses of diamonds for most efficient wheel shaping.

COMING

Now is about the right time to unveil a series on the working of sheet aluminum—even at the risk of being a little previous, since the articles aren't scheduled to begin until the next number. We feel it's something to look forward to, though, as the subject is not only exhaustively treated but is of extreme present-day importance as well. The series has been prepared by several experts of the Aluminum Company of America, an organization which probably has accumulated more information on aluminum than any other in the world. Herewith we take pleasure in introducing to you the first two authors of the articles. At the left is Dr. L. J. Weber, while at the right is J. T. Weinzierl. In front of both is a drawing you'll soon see in AMERICAN MACHINIST.

DR. L. J. WEBER and
J. T. WEINZIERL
. . . all about aluminum

TOOL AND DIE SHOPS SAVE TIME
WITH THE
CINCINNATI UNIVERSAL TABLE

. . . because it revolves to any angle; rocking top tilts above or below horizontal; vise swivels for rotation of work.

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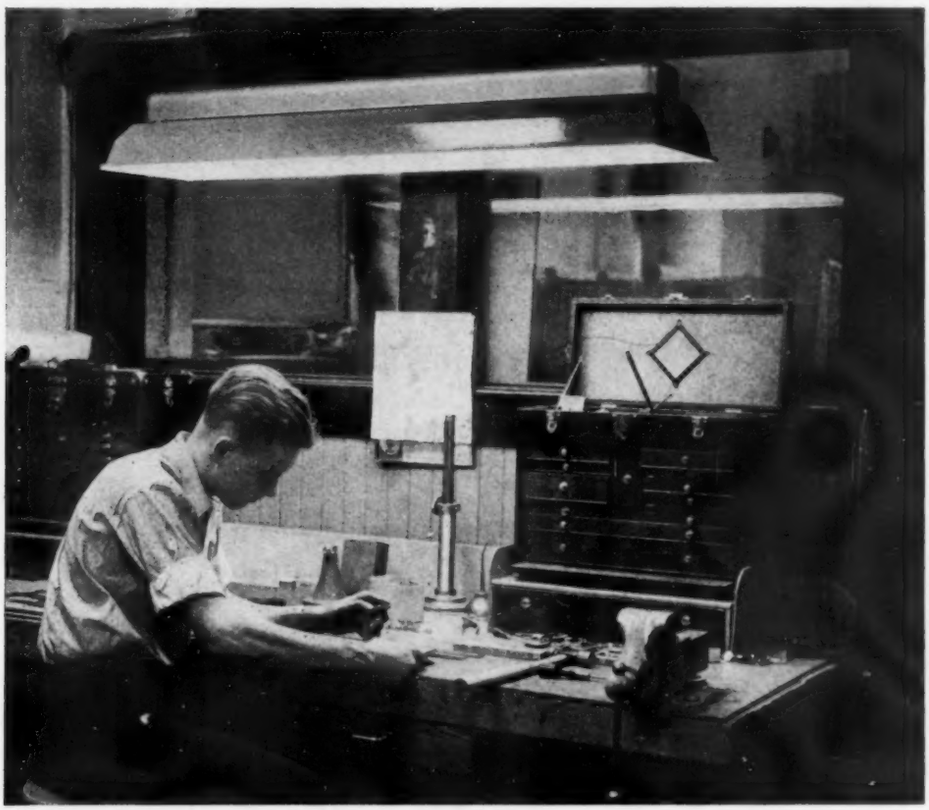
ESTABLISHED 1877 **AMERICAN MACHINIST** BURNHAM FINNEY, Editor



Bench work requires a high level of good quality illumination. In this case it is provided by an RLM unit equipped with two 40-watt daylight fluorescent lamps

Fluorescent facts

BY DEAN M. WARREN, NELA PARK ENGINEERING DEPARTMENT, GENERAL ELECTRIC COMPANY

Like many other production aids, fluorescent lighting has certain tasks that it meets best. Here's engineering data to help fit it to proper jobs

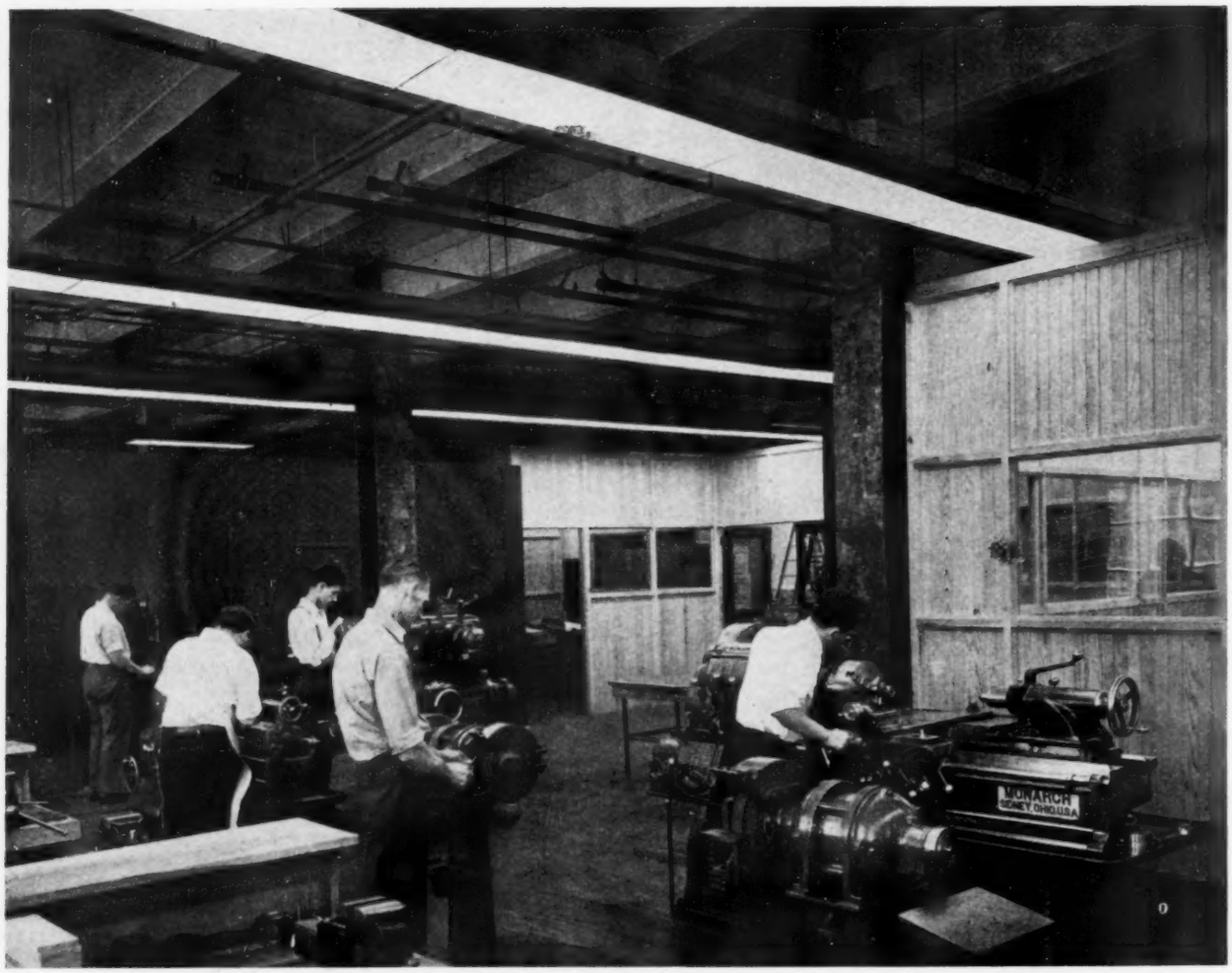
SPEEDING UP OUTPUT to meet present demands has forced industry to take immediate advantage of every known production aid. Good lighting is a proven aid. The newest source for providing illumination levels required for quick and efficient seeing is the fluorescent lamp. Outstanding advantages of this lamp are:

1. It economically produces light of daylight color quality.
2. It permits higher lighting levels to be obtained with existing wiring, provided power factor correcting equipment is used at the lamp.
3. It produces cooler illumination, an important factor in obtaining high-level lighting with comfort. One-hundred foot-candles are now entirely practicable from this standpoint.

The fluorescent lamp is of the electric discharge type, employing mercury vapor as the medium for maintaining the arc. The tube converts invisible ultraviolet energy, produced by the arc, into visible light by fluorescent powders which coat the inner surface of the tube.

Fluorescent lamps are at present made in six wattages, six lengths and four diameters. Wattages shown in the specification table do not include the watts consumed by auxiliary equipment. This amounts to from 20 to 30 per cent as much as the lamp.

In common with all electric discharge tubes, fluorescent lamps must have auxiliary control equipment. Specifically designed control units are required for each wattage, frequency and voltage range. This equipment is



Continuous rows of 40-watt fluorescent lamps provide machinists with 40 foot-candles of well diffused lighting

available for operating either a single lamp or two lamps, the latter being designated as a Tulamp ballast. Both correct power factor to better than 90 per cent. For 30- and 40-watt lamps Tulamp ballasts are more economical than individual ones for each lamp. In addition, they reduce stroboscopic effect by causing the lamps to operate out of phase with each other so that the light fluctuation becomes comparable to that of low-wattage filament lamps. Plants that have installed fluorescent lamps prior to the development of high power factor ballasts, and who have not thus far made correction, will find it to their advantage to correct power factor by installing a capacitor. These are available today which correct as many as five lamps to 90 per cent power factor or better, thus enabling efficient utilization of the wiring.

The fluorescent lamp is designed to give its best all-round performance within the specified voltage range. Lowering the voltage will not necessarily increase the life of the lamp as is the case with filament lamps, because such treatment places a greater burden on the electrodes, causing them to operate too cool. Excessive voltage causes a shortening of life because of the more rapid use of electrode material. Enough data are not yet available to establish definitely the magnitude of the effect of under- and over-voltage operation on lamp life. For the present it appears that from a life standpoint the lamps should not be operated at voltage less than 105 (210) nor more than 125 (250), and wherever possible the lamps should be burned within the recommended range of 110-125 (220-250).

In general, fluorescent lamps lose their usefulness because of decrease in light output before they fail. The rate of depreciation in light output diminishes throughout life; the first 100 hours produce about as much darkening as the following 1000 hours.

Frequent starting of lamps may take more life out of electrodes than long hours of operation. If a lamp is started once a minute, for example, the hours of use will be shorter than normal, but if it is turned on and operated continuously, its life will be longer than usual. When the active material on the electrodes is nearly exhausted, the voltage required for starting will rise and may exceed the available supply. This may occur after the lamp has been started thousands of times or burned beyond its rated life.

During about the first 100 hours of operation, the light output from fluorescent lamps drops considerably, often as much as 10 per cent. For this reason the lumen outputs given in the table are based on readings taken after this initial loss has occurred. Since the output from new lamps is considerably greater than published values, foot-candle readings taken shortly after making complete installations of new lamps may be somewhat higher than the illumination level designed.

Introduction of new light sources always results in some confusion as

Physical and Electrical Specifications of Fluorescent Lamps

	18-inch	*24-inch*	*36-inch*	*48-inch*	*58-inch*	*60-inch*
Nominal Watts....	15	20	30	40	85	100
Circuit Voltages...	110–125	110–125	(199–216) (220–250) (110–125)	(199–216) (220–250) (110–125)	(95–125)* (190–250)*	(199–216) (220–250) (110–125)
Diameter, Inches..	1	1½	1	1½	1¼	2⅛
Rated Life, Hours.	2500	2500	2500	2500	3000	2000
Lumens — Daylight.....	495	760	1250	1800	.....	.....
Lumens — White..	585	900	1450	2100	4000	4400
Lumens — Bluish-White.....	.....	.....	.....	.....	4000	.....

* Auxiliaries equipped with tap changing switches to provide for prevailing voltages.

to their proper application. This has been true of the fluorescent lamp. It is a low-powered source and this naturally places some limitations on its use. A sound practice is evolving and fields of logical application are being extended as new equipment is developed. Before introduction of the 40-watt 48-in. lamp and the 85-watt 58-in. lamp, fluorescent lighting was largely confined to supplementary installations. The 85-watt lamp, the 100-watt lamp and the recently developed RLM unit using two 40-watt lamps can serve as general light sources. The accompanying tables give approximate foot-candles obtained for various installations.

One of the outstanding features of the fluorescent lamp is the precise and efficient manner in which light of daylight color quality is produced. Light from the daylight lamp is the nearest approach to natural daylight that it has ever been possible to produce directly by an artificial illuminant at high efficiency. This immediately suggests the use of the lamp for operations requiring color discrimination. For such work North Skylight and Noon Sunlight equipment has long been available. One shortcoming of such equipment is the high wattage required, which too often results in a compromise with foot-candles produced. With the fluorescent lamp high levels of daylight quality can be provided with no discomfort from radiant heat.

It might seem that the ability to see objects in their true colors is important only when actually matching two pieces of material or when it is desired to see colors in their original conception, as those of an oil painting. But colors can help very much fundamentally in the process of seeing. For example, in looking at a brass bushing on a steel machine part, the two metals might have exactly the same reflection factor and yet be indistinguishable under light which does not show their true colors. Since, in a great many applications, it is color difference which renders objects instantly recognizable and which reveals the line of demarcation between them, color discrimination is important from a utilitarian point of view.

Both the daylight lamp and the white lamp, which produces light of a color quality approaching that of the daylight filament lamp, are being used as supplementary sources to provide high-level illumination for inspection and for lighting lathes, work benches, etc. Two characteristics of the lamp make it quite suitable for such applications: its low brightness and its coolness. The former is important because the majority of seeing tasks performed in these locations have to do with reading scales, micrometers, or observing work which is of a polished or semi-polished nature. Researches made by the Illuminating Engineering Society have revealed that highest visibility is obtained when a source of large area and low brightness is employed. Fluorescent lamps in suitable reflectors may be so classified. Cool foot-candles are important because the source is generally located about 3 to 5 ft. above the workman's head.

Lighting economies have always involved quality and general satisfaction as well as costs, and the problem of true economics has never been revealed by arithmetic alone. Fluorescent lamps produce daylight economically, which filament lamps cannot do. They produce cool foot-candles and are sources of extended area and low brightness. Their industrial application today is in cases where these qualities are sought.

Average Foot-Candles Produced by 85-Watt RF Fluorescent Lamps

Area per outlet and approximate spacing	*Distance from reflector to floor to be not less than*	*Conditions*	*Average foot-candles*
55–65 sq.ft. 7¾x7¾ ft.	7½ ft.	Favorable	30–36
		Average	24–30
		Unfavorable	18–24
65–75 sq.ft. 8½x8½ ft.	8½ ft.	Favorable	26–31
		Average	21–26
		Unfavorable	16–21
75–85 sq.ft. 9x9 ft.	8½ ft.	Favorable	23–27
		Average	18–23
		Unfavorable	.....
85–95 sq.ft. 9½x9½ ft.	9 ft.	Favorable	40–48*
		Average	32–40*
		Unfavorable	24–32*
95–110 sq. ft. 10x10 ft.	9½ ft.	Favorable	35–42*
		Average	29–35*
		Unfavorable	22–29*

* Two lamps at each outlet.

Foot-candles for Continuous Rows of 40-Watt Daylight Lamps

Area per reflector or spacing between rows	*Reflector to floor to be not less than*	*Conditions*	*Average foot-candles*
21.6 sq.ft. 5 ft.	7½ ft.	Favorable	67–74
		Average	50–62
		Unfavorable	37–50
26 sq.ft. 6 ft.	7½ ft.	Favorable	51–62
		Average	41–51
		Unfavorable	31–41
30.4 sq.ft. 7 ft.	7½ ft.	Favorable	44–53
		Average	35–44
		Unfavorable	26–35
34.6 sq.ft. 7 ft.	8 ft.	Favorable	39–46
		Average	31–39
		Unfavorable	23–31
39 sq.ft. 9 ft.	8½ ft.	Favorable	34–41
		Average	27–34
		Unfavorable	20–27
43.3 sq.ft. 10 ft.	9½ ft.	Favorable	31–37
		Average	25–31
		Unfavorable	18–25

These values are computed for two lamps in each reflector.

Pictures put it over

BY MERRITT LUM

When it comes to ironing out personnel problems, a foreman skilled in human relations can be as competent as a family doctor

Any foreman skilled in human relations can work wonders in keeping production humming. But how to train him? Here's a realistic, effective method

"AT LAST we've got our supervisors really interested in human relations!" This was the enthusiastic statement of the plant manager for a New England metal-working company at a meeting of industrial executives.

It was a frank confession. At first, it startled the group; then it brought forth admissions from most as to the difficulties of training supervisors in personnel relationships.

"It wasn't our material that was at fault," this New England manager continued. "Rather, it was our method. Thank heaven we've found the answer to that problem."

That evening the answer was shown to the entire group. There was no secrecy about how it was found. The turning point was recognition that even the most valuable and fundamental principles of action are apt to go in one ear and out the other—to gain lip service, but not reality in action. It was recognized that only as principles of action are made realistic, vivid, and expressed in terms of moving human experiences of John and Bill, do they press home.

Hence this New England company had turned to the sound slide film as the key to its entire training program. The company official who had embarked on this venture soon learned that developing a convincing presentation was not quite as simple as it looked. There proved to be far more to it than putting together a series of interesting pictures and accompanying dialogue. It took his company about a year to produce its first acceptable picture; through trial and error a satisfactory job finally resulted.

When the film was shown to supervisors, even though the subject was a familiar one—turning down requests—they seemed to get the principles as never before. They remembered them. They began to discuss them, not as copy-book maxims, but in terms of every-day actions and problems. And they voluntarily began to apply these principles in their work. The realism got home.

The over-all effects were so marked that no time was lost in planning future productions. Soon it became apparent that there was a need for joint effort by which this dramatic-experience training method could be made available to companies throughout the country. Last fall the National Association of Manufacturers became interested in the project, and appointed a special committee to oversee production of a program broad enough to be utilized by most plants. The production task was assigned to a group of specialists in the art of dramatization.

As the committee got into the question of improved training technique, it found a great variety of subjects for which the dramatized case experience type of presentation was needed. Association members reported their requirements. From the wide field the committee chose for initial production six subjects as being representative of current needs. Topics on which films have been, or are being, produced are: *The Supervisor as Manager, The Supervisor as Trainer, The Supervisor as Leader, Letting Men Know Where They Stand, The Reprimand,* and *The Grievance.*

Insight into the practical character of these new films is gained by the sample shots reproduced herewith. These are taken from more than 100 scenes included in the third film—the one on leadership, entitled "When Something Goes Wrong." In a running sequence of factory scenes, the story of actual contacts is told by sequence and voice, reproduced so naturally that attention is effectively concentrated on the events portrayed.

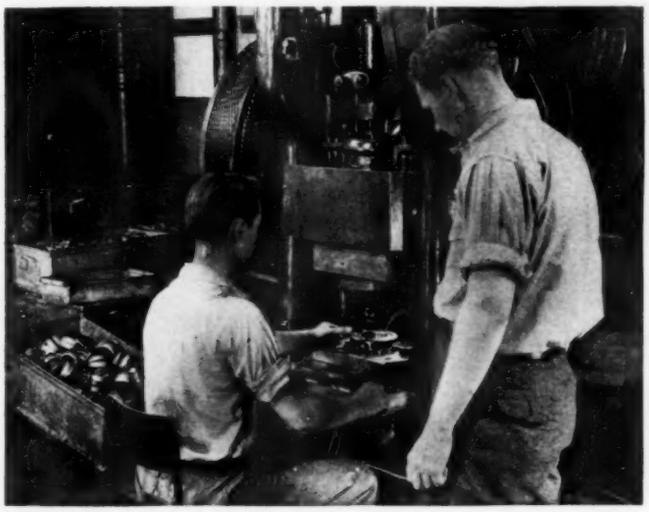
Almost universally, when supervisors have seen this film, they have exclaimed, "Why, that might have been me!" or "That's my problem!" Thus the ground is laid for a lively, realistic discussion between supervisors on how to improve their shortcomings, how to tell where training is needed, how to make it more thorough. Although aiming at a specific problem, the film covers much ground.

Although the six initial films form a course in major industrial relations, they need not be used in any given order. Each is self-contained. With each is a specially developed discussion guide. Requiring fifteen minutes for each showing, the films are a welcome springboard for discussion groups. They can be used to brighten and intensify mass meetings.

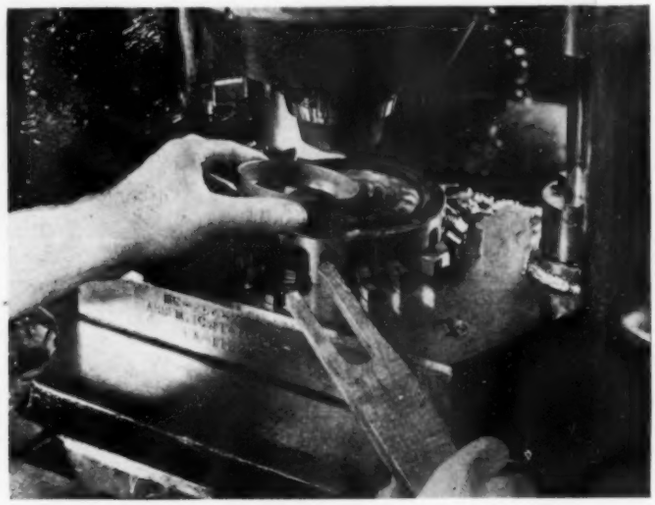
Harrassed managers and training directors have asserted that this program will do "a job that we have been unable to do. It puts over our story in a way that not even our most thoughtful suggestions, our lectures, our writings seemed able to do."

"You're way over your spoilage quota, Dick," a supervisor tells a foreman. "Let's see if we can't get at what's back of it . . ."

". . . The other day you told Mike, 'Say, if I took time to explain everything, we'd never get work out.' Shouldn't we study that approach?"

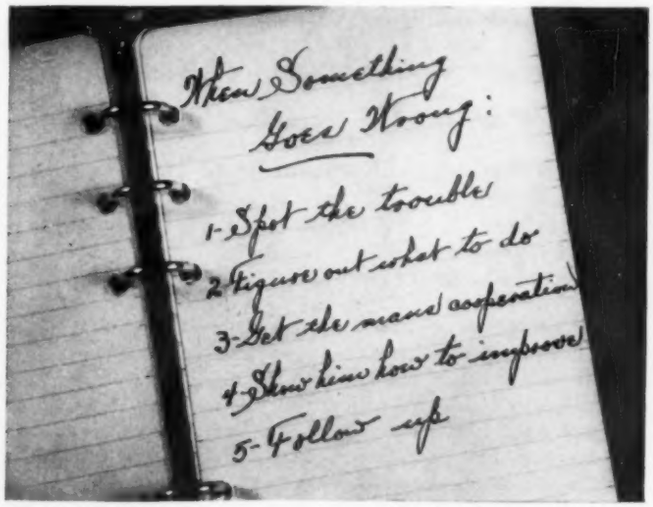


Dick makes a new approach in his relations with his men. He takes time to spot their trouble

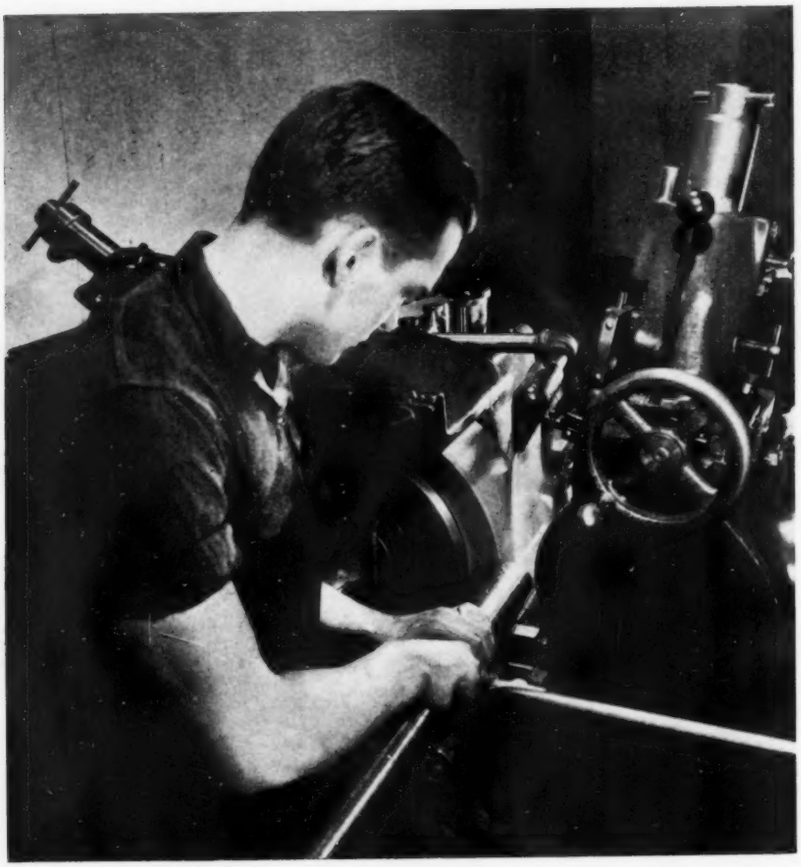


"There seems to be some trouble in seating it, Mike. I notice you pull your hand back . . ."

By careful analysis Dick spots faults, and by tactful suggestion gets his men to correct them


When Something
Goes Wrong:
1- Spot the trouble
2- Figure out what to do
3- Get the man's cooperation
4- Show him how to improve
5- Follow up

Dick now has a program for "when something goes wrong." To him it's as important as specifications



Small-lot centerless grinding is most economical when set-up changes are held to a minimum. Work is usually scheduled to consist of all through-feed or all in-feed, with diameters running progressively from largest to smallest. Here is a centerless machine set up for grinding 2½-in. diameter bars

Centerless for small lots

BY R. W. PEASLEE, PRESIDENT, EASTERN CENTERLESS GRINDING COMPANY

Huge quantities aren't needed to achieve economical centerless grinding. The secret lies in proper production planning

A GENERAL but erroneous opinion is that centerless grinding is exclusively adapted to large-lot mass production.

Actually the centerless grinder is as well suited to short runs of widely different and frequently changed parts as is any machine tool. If it were not, this company could hardly keep operating for we do a strictly jobbing business in centerless grinding. In fact, we have no machines except centerless grinders.

Occasionally we get an order for a million or more identical pieces on which a machine can be kept busy for several weeks. These are few and far between. More often our orders go to the other extreme—a lot consisting of a single piece. The bulk of our business is made up of lots of from about 25 to 500 pieces each.

We can handle economically a wide variety of work. Materials include cast iron, steel of various analyses and hardness, aluminum, copper, brass, bronze, enameled iron, and many types of plastics. Changing materials usually calls for considerable down time, for it is frequently necessary to change wheels and coolant—which involves complete cleaning of the machine and coolant tank.

In the drawing, page 962, is a typical batch of parts to be ground on one machine. The sketches are in the order in which the orders were received. Numbers refer to quantity to be produced. Each job, of course, requires its own set-up. In most shops which make standard products —even a wide variety of them—it is possible to hold up a small order until enough similar parts have been accumulated to get a fairly long run. This is seldom possible for us, for many of our orders give us only a couple of days in which to make delivery. However, it is sometimes possible to accumulate several less urgent orders for parts made of the same material and run them through together.

Some Ways to Save

The secret of economical centerless grinding of small lots is intelligent production planning. This does not call for elaborate planning boards nor

complicated paper work. It is a matter of common sense and knowledge of the time required to change the set-up for one part to a set-up suited to another.

It takes less time to change the set-up for a through-feed job to that for another through-feed job than to change from a through-feed job to an in-feed one. Therefore when planning the day's production for a certain machine we try to make it all through-feed or all in-feed.

Next we try to group lots of parts whose diameters are not too different, so that the changes in set-up will come in as small steps as possible. It takes longer to make changes for large differences in diameter than for small ones.

Take the typical jobs illustrated. They were scheduled in order of diameters starting with the largest, and ending with the pound of brass wire. All were through-feed jobs. If these parts had been put through in the order in which they were received, each set-up might well have taken from 30 minutes to an hour. But when scheduled so that they were processed in the order of declining diameters the set-up times were from 15 to 25 minutes each. This procedure is elementary, of course; but it is often overlooked or ignored. In it lies the secret of economical centerless grinding of small lots.

How to Compare Costs

Since we do nothing but centerless grinding, we do not have to determine whether it is the most economical method for a given job. Our customers decide whether a part shall be centerless ground. But for the shop which has both centerless grinders and cylindrical machines, it is handy to have some method which will help decide which method will be more economical.

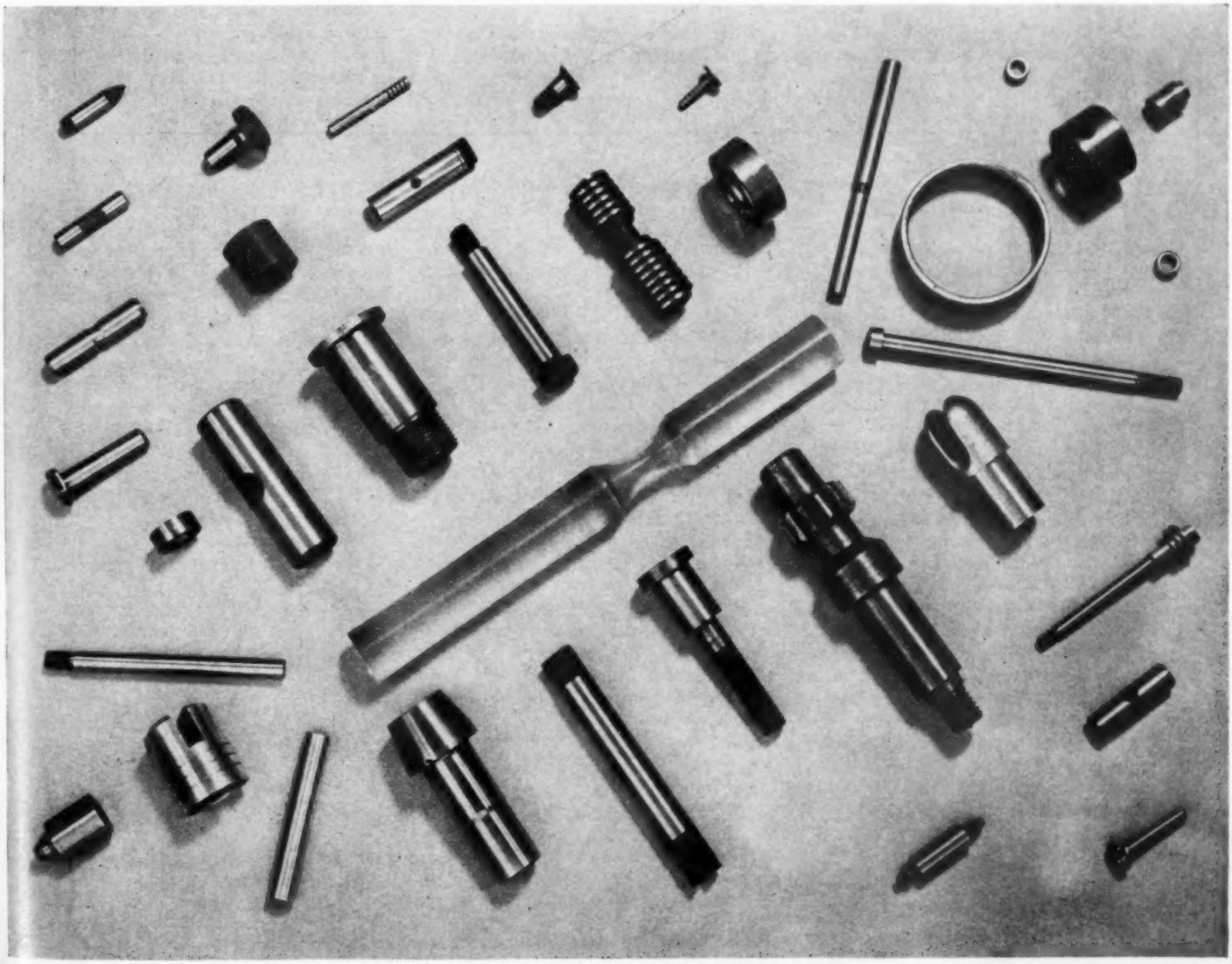
Here is a simple formula which, while not absolutely accurate, is at least indicative. Let

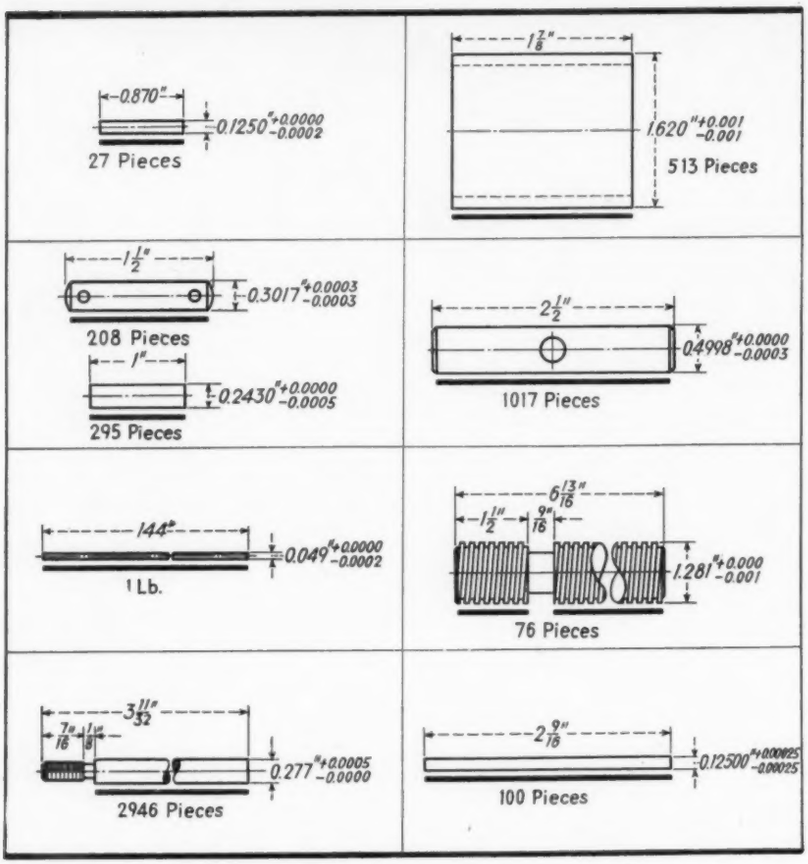
$M.L.$ = Value determining whether the work should be ground on the centerless grinder,
A = Set-up time for centerless grinder,
B = Set-up time for cylindrical grinder plus time required for drilling center holes and an allowance for truing center points,
C = Grinding time for cylindrical grinding each piece,
D = Grinding time for centerless grinding each piece.

Then $$M.L. = \frac{A - B}{C - D}$$

If $M.L.$ is less than the quantity in the lot, theoretically the job can be more economically done by centerless

These widely differing parts were all finished economically by centerless grinding. Quantities ranged from 1,000,000 for the small iron core in the extreme upper left to 1 for the slotted shaft at the bottom. Tolerances were often of the order of two or three tenths. Materials below include iron, steel, stainless steel, brass, Bakelite, aluminum, and transparent plastic for the center handle





If ground in the order in which they were ordered, each of these parts would have necessitated about an hour for setting up. Scheduling them from the largest diameter progressively down to the smallest cut set-up times to an average of about 20 minutes

grinding. If *M.L.* is greater than the lot quantity, cylindrical grinding will be more economical. However, if the difference is slight and if the centerless machine has time available, it may be better to assign the job to the centerless.

Incidental Economies

There are other factors which may make it desirable to do a job by centerless grinding even though the formula indicates that it will be more economical to do it on a cylindrical machine. Since there is no deflection in the piece caused by wheel pressure, the danger of inaccurate work and poor finish from that cause is eliminated. Since there is no axial pressure, as when work is ground between centers, that cause of possible inaccuracy is eliminated. These factors tend to reduce losses from spoiled work—resulting in an additional time saving which is not taken into account in the formula.

However, this is not intended to be a treatise on the advantages of centerless grinding. The point is that long runs need not be available in order to make centerless grinding economical. If the foreman or production man knows his machine and has detailed knowledge of what makes for quick, inexpensive set-ups, a diversity of parts in surprisingly small lots can be effectively handled on a centerless machine.

Saving Time and Teachers in Training

MASS TRAINING requires mass instruction. The old method of individual teachers is as much out-of-date as individual assembly in a motor shop. There are not enough teachers and it would take too long, if there were.

Visual education, by the use of moving pictures, has proved successful in mass education. It has been used by the Signal Corps, the Ordnance Department of the Army, and by the Navy, and has proved to be a great time saver. The Navy used it in teaching firemen who were brought up on coal, to handle oil burners. The Ordnance Department uses it in teaching the action of shrapnel.

The operation of machine tools, in general, or of special operations, can be shown so clearly that the time of personal teaching can be greatly reduced. In some cases "slow motion" helps greatly. In others some form of "animation," as done by Bray and Disney, makes clear the workings of parts that are not visible to the eye. It makes it much clearer than even a sectional machine, which cannot be operated.

This method can be used to great advantage in training ground crews in aviation. As every plane needs eight men on the ground, the training of the ground crew is a gigantic task by the older methods. Pictures can show the handling of planes in and out of the hangars. They can show just how motors are removed and put in place. Slow motion of the sequence of operations in disassembly can show a large class the routine to be followed. The same is true of inspection for wear, of defects that warrant rejection, and of re-assembly of units and complete motors.

Competent instructors will be needed to handle special problems as they come up. But pictures can relieve them of much of the teaching routine, and help produce trained men in less time.

When the students start to handle the parts or the machines, the pictures can be run again to refresh any lapse of memory. It might even be well to use one of the commercial projectors which run continuously, showing the whole reel at regular intervals. Such a continuous showing would enable any student to see just the point on which he is hazy, and possibly save making an error that would damage both work and machine, in the case of shell turning, or similar munitions work.

Builders of machines to be operated by newly-trained men, makers of airplane motors and their accessories, propellers or landing gears should find it advisable to have such films prepared. The Air Corps could use several such films in training the ground crew. They might well cooperate with the builders in having suitable films made.

Pictures alone will not produce trained mechanics. But they can help instruction more than many realize.

How to use truing tools

BY H. J. WILLS, ENGINEER, THE CARBORUNDUM COMPANY

The forming of fillets and convex or concave surfaces on the face of a grinding wheel requires considerable care in the selection and operation of tools

SMALL RADII for forming fillets, or to give the advancing edge of the wheel clearance, commonly are formed with an abrasive-stick dresser. If the face of a wheel must have a precise convex or concave radius a diamond should be used in a precision radius truing fixture such as those shown in Figs. 17, 18 and 19. It is a good plan, when a wheel's sides act too soft, to diamond dress the sides of the wheel to a depth of several inches, and then dress the periphery.

When the same contour must be formed repeatedly on wheels, a steel profile templet or cam should be provided. This templet is rigidly mounted on the grinder directly opposite the wheel. The diamond holder pivots on a fulcrum and is firmly held in contact with the templet. As the diamond is traversed across the wheel, the templet guides it into the wheel face. This saves time over hand truing and insures that the form always will be the same. The tool pivot bearing must not be too loose, or the tool will gouge the wheel and the diamond will not follow the cam exactly.

Thin edges or sharp corners on the grinding wheel call for sharp dressing tools. A dull tool will require so much pressure to make it penetrate the wheel that the weak edges are apt to be chipped or broken. The cut should start at the weakest point and, if possible, should be taken from the extreme periphery toward the arbor.

Many cylindrical grinding jobs, whether done between centers or in a centerless grinder, involve grinding several diameters simultaneously. If the corners must be sharp, truing requires considerable skill and often must be done with special equipment.

One method is to use the offset diamond holder shown in Fig. 20. This usually is a "drop" shaped stone, which must be large so that it can be firmly mounted with enough of the stone projecting to reach into the corner. Objections to this method of forming a sharp corner are that the large diamond is excessively expensive, the necessary overhang from the mounting is a prolific cause of diamond breakage, the tool cannot be turned to maintain a sharp edge, and only a few truings can be done with a single setting of the stone. Another method is to use an ordinary stone in the offset adapter shown in Fig. 21. With this adapter, the tool can be turned to provide sharp edges, but the long overhang may cause vibration in the tool.

The diamond shown in Fig. 22 is lapped to cut a right-angled corner. It has the advantage that it can be set close to the wheel and so obviate vibration. However, it is an expensive tool and is useful only so long as the lapped edges stand up. The hardest, and therefore the most useful, part of the stone, the skin, is lapped away in forming the stone by this method. The adapter shown in Fig. 23 permits advantage to be taken of the cleavage planes in both of the two directions in which the stone may be set.

Since wheels used for snagging and fillet grinding should remove material rapidly, it is essential that their faces be rough and open. The *star* or Huntington dresser is used. It is held in a single location until the wheel is sufficiently dressed, then moved three-fourths of the tool width and dressing is repeated until the wheel face is completely dressed. Truing the face of the wheel slightly convex will increase its life. If the wheel is of too hard a grain or too fine a grit for the purpose, corrugate or ser-

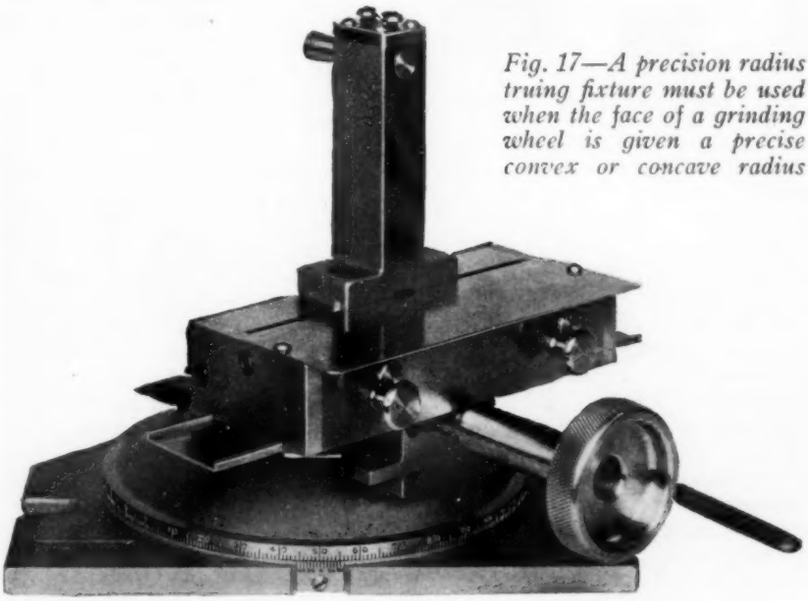


Fig. 17—A precision radius truing fixture must be used when the face of a grinding wheel is given a precise convex or concave radius

rate the face by locking the dresser disks in series of patterns, so that they cannot rotate as individuals on the pin. A rigid dresser support is essential in dressing snagging wheels.

Surface grinding wheels for roughing may be dressed with a silicon carbide dressing stick mounted with sulphur in a cast-iron holder. This holder is supported by the chuck, while the wheel is passed over it at a fair cut. If the wheel is to be subsequently used for finishing, from 0.003 to 0.005 in. stock should be left on the work. To dress the wheel for finishing, use a slow traverse and take a light cut with a diamond. Since surface grinding often is done dry, the dressing also should be dry, and plenty of intermissions allowed for cooling.

Ring and segmental wheels are dressed best with a Huntington type dresser, provided it is properly supported. If a smooth surface is required, the precision steel type dresser is best.

When large resinoid-bonded wheels have tracks worn in their faces, they may be trued to a commercially perfect plane with a Huntington dresser held in a bar guide. For dressing

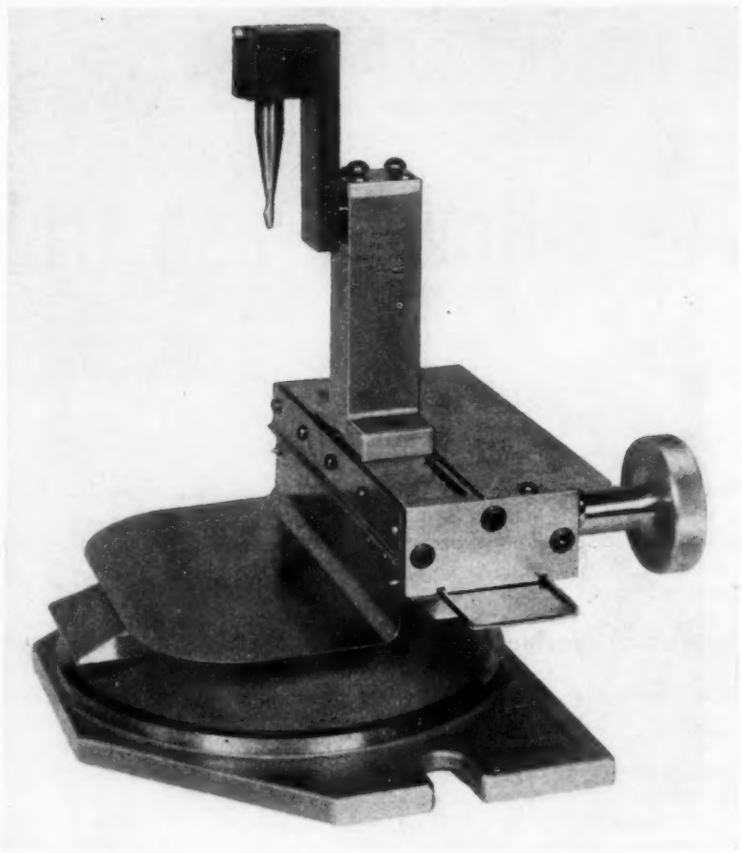


Fig. 18—For some contour-truing operations, this type of diamond holder is of advantage

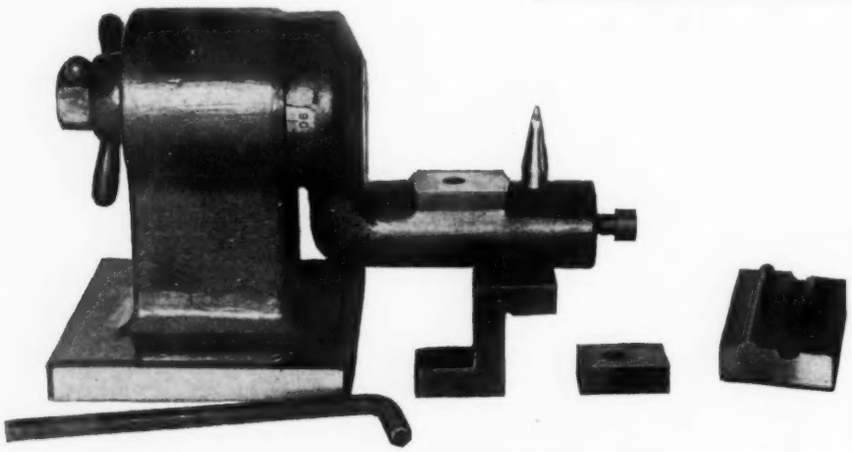


Fig. 19—This form-truing fixture is adjustable for truing in a horizontal or vertical plane, and has a special gage for setting the diamond on center

only, the wheel may be held in the hand. Double disks which are parallel to each other must be dressed with a double wheel dresser. If possible, the disk should be dressed from the center outward in order to allow the cuttings to be thrown free of the wheel.

Except for surface grinders, all toolroom wheels are rough formed with silicon carbide sticks held in the hand. Sharp corners, small radii and finish forming is done with a diamond tool, held in an adjustable mount, such as shown in Figs. 17, 18 and 19, or with a hand-held tool.

For the run of cylindrical grinding jobs, the wheel may be dressed satisfactorily for roughing by passing a diamond rapidly across the face with a tool feed of not more than 0.001 in. One pass usually will be enough. If the same wheel is to be used for finishing, make one pass at rapid traverse with a tool feed of 0.0001 to 0.00015 in. for a soft wheel. If the wheel is hard a feed of 0.0005 in. may be used. Then reduce the traverse by a half and make one or two passes with a feed of 0.0003 to 0.0005 in. Repeat without dresser feed to remove any high spots.

With this method of truing, threads may appear on the first few pieces ground, but the cutting action of the wheel will be rapid and the finish good. If only one piece is to be ground, or if it is necessary to have a fine finish on all pieces in a lot, this dressing procedure should be followed by several passes at diminishing feeds and traverse. This will reduce the cutting action of the wheel, which must be compensated for by adjusting the wheel feed when grinding.

If a wheel loads when taking a roughing cut, the bond may be broken down by serrating the face by deep diamond cuts at a very rapid traverse.

While many cylindrical grinding wheels may be dressed inexpensively with an abrasive wheel dressing tool, diamonds are recommended.

Since some chilled iron rolls need not have a high quality surface, diamond expense can be saved by dressing with an abrasive wheel, or steel tool. If a better finish is required,

iron and dull grains may be removed with a *star* dresser and a diamond can be used for giving the final finish. This saves diamond cost, but does not reduce dressing time.

Hardened steel and chilled iron rolls which are to be used for cold rolling must be ground to close tolerances and given fine surfaces and finishes. The grinding wheels must be dressed carefully and skilfully with diamonds. While no special precautions or methods are called for, it is important that the edges of the wheel be rounded before and after dressing, using either a hand stone or forming tool for all finishing cuts, regardless of wheel fineness. Very fine grinding, such as is required on cold strip rolls, often may be improved by taking a slight truing cut on the wheel sides for a distance of $\frac{1}{4}$ in. before rounding the edges.

Since crankshaft finishing usually is done by lapping, the quality of the grinding is a matter of dimensional rather than surface perfection. Therefore, the wheels may be dressed and trued satisfactorily with an abrasive wheel tool. It is, however, necessary to true the grinding wheel sides and radii with a diamond or abrasive stick.

In shops where high production of crankshafts is more important than tool costs, the diamond rather than the abrasive wheel dresser should be used, even for roughing cuts. Roughing cuts usually require only one truing with the diamond at a coarse feed and rapid traverse. The sides and radii of the wheel are trued when necessary. Finishing wheels call for more care and skill. The wheel sides are first trued to a gage with a sharp diamond. A dull diamond will produce a cutting surface that is apt to burn or check the crank side-walls. It is desirable to use a duller diamond on the wheel face, or to take a greater number of passes with a sharp diamond without feed in order to avoid dressing marks on the work. The diamond is passed across the face at a slow traverse, with about 0.001 in. feed. For "cutting back" to restore radii, it is economical to use a steel or abrasive wheel tool first and then finish with a diamond.

Keep Diamonds Cool

Cincinnati centerless grinders come equipped with truing fixtures for correctly truing and dressing both the grinding and regulating wheels. There are several points to keep in mind when using these fixtures due to the difference between centerless and center type grinding machines.

When dressing wheels for centerless grinders, it is not sufficient to depend upon the spray from the wheel for cooling the diamond. Keep a stream of water playing on the diamond. It sometimes is overlooked that the position of the diamond is the reverse of that in center-type grinders. It is set in back of the wheel. Therefore, to prevent the stone from gouging the wheel, it must be canted *upwards,* instead of down as in center-type machines.

Internal grinding wheels are usually dressed and trued with a diamond tool. However, the rough truing may be done with a silicon carbide dressing stick, and the final truing with a sharp diamond at a rapid traverse and light feed.

As an internal grinding wheel decreases in diameter through wear, the wheel action changes noticeably, due to the changed surface speed and arc of contact with the work. If a fixed diamond is adjusted to dress at the wheel center line, the wheel will be reduced the same distance from the center line of the workhead with no provision for compensating for the constantly changing wheel action. Therefore the position of the diamond must be changed constantly as the wheel gets smaller. This must be determined largely by trial as no set rule can be made to fit all conditions. Dressing on the center line will cause succeeding pieces of work to be ground smaller in the hole. On the other hand, if the dressing is too high or low, they will be ground larger. This is important in "Sizematic" and similar internal grinders. Unusual conditions should be taken up with the manufacturer of such machines in each case in order to get his recommendations.

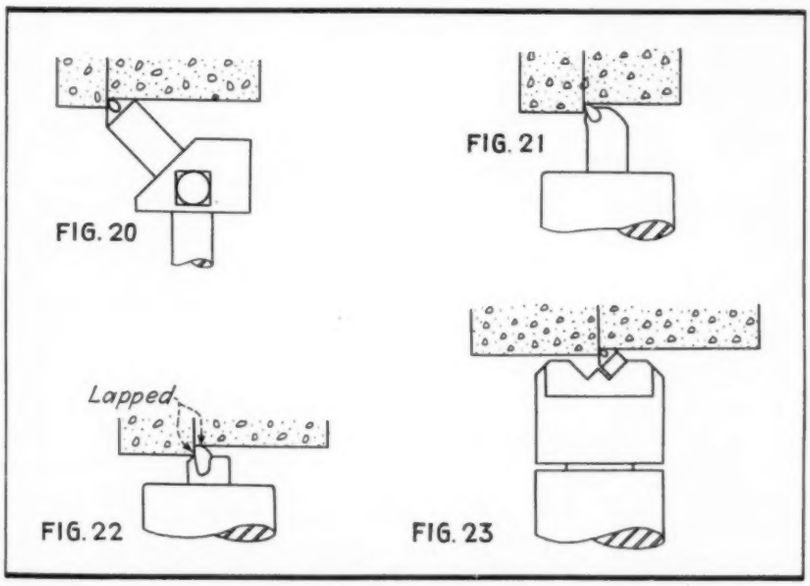


Fig. 20—A "drop" shaped, expensive diamond is needed in this type holder for truing sharp corners. Fig. 21—An ordinary stone can be mounted in an offset adapter for truing sharp corners. With this arrangement the diamond can be turned to provide sharp edges. Fig. 22—The diamond used in this set-up for truing sharp corners is lapped to shape. It can be used only so long as the lapped edges stand up. Fig. 23—This adapter permits setting the diamond in two positions

Rounded Threads

TO SECURE greater strength and longer fatigue life in threaded parts used in aviation engines and other fittings, the rounded top and bottom idea is being seriously discussed by the aircraft engine division of the SAE standards committee. Joseph Whitworth knew the advantages of the round top and bottom, but as it seemed unnecessary at that time, the flat top and bottom proposed by William Sellers was adopted.

This was a great improvement on the old V-thread and has been satisfactory for a great majority of work. It is easier to make than the round top and bottom and still has its place.

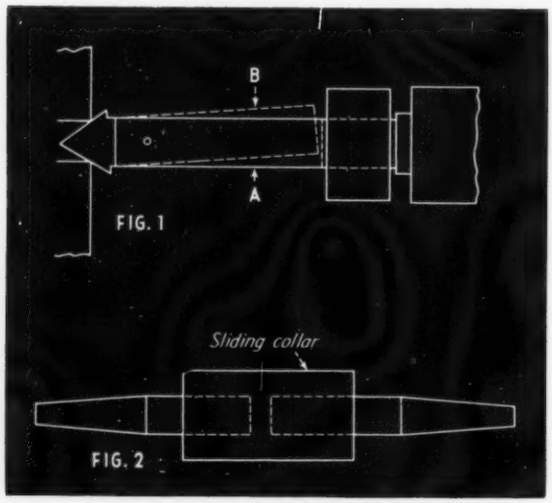
The demands for the utmost safety are likely to lead to the abolition of all corners in thread form for aircraft and similar uses. The radius will probably not conform to the Whitworth, but the idea is growing.

IDEAS FROM PRACTICAL MEN

Testing Alignment of Tailstock Spindles

By J. DAVIES

The alignment of the tailstock spindle with the live spindle should be checked, especially before undertaking reaming operations on a lathe. The pivoted two-piece alignment device *A* described by J. H. Moore (*AM*—Vol. 84, page 508), does not seem very practical for this purpose. For instance, if the head and tailstock centers were the same height but the tailstock a little off center laterally, and Mr.



The device in Fig. 1 for aligning lathe centers may not indicate centers out-of-line laterally but in alignment vertically, unless it is rotated. A suggested improvement is shown in Fig. 2

Moore's tool placed in the tailstock, as in Fig. 1, there would be no movement of the movable piece *B*, as shown by the dashed lines, since it can only move in one direction. To overcome this, the tool would have to be turned around in the tailstock to different positions. A suggested improvement is shown in Fig. 2; this consists of two pieces of stock turned exactly alike, one to fit the tailstock, and the other the headstock, with a sliding collar to pass over the parallel parts as suggested by Mr. Moore.

Finger Feed for Blanking Dies

By H. R. HAGEMAN

The finger feed for blanking dies, described by Henry W. Falstrom (*AM*—Vol. 84, page 664) hinges in the punch holder or punch plate, and drops back from its own weight during the upstroke of the punch. The drawing of the finger feed fails to show why the feed fitted for a $1\frac{1}{2}$ in. stroke cannot be used in a press with a 2 in. stroke or greater.

It would seem that if a positive stop were placed in the punch plate so as to prevent the finger dropping too far backward, the punch holder with its assembled parts could be raised to any height and the feed would start functioning when it was lowered to its operating position.

If such is not the case, a description of a simpler type of finger feed which will operate in presses of various strokes can be found on page 13 of "Die Design and Diemaking Practice," Industrial Press.

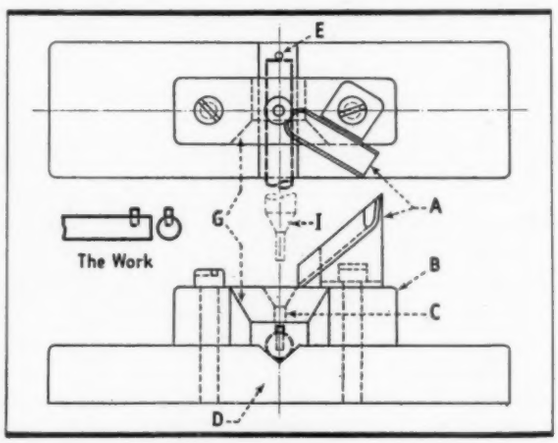
Rapid Assembly of Pins in Small Shafts

By GEORGE WILSON

The illustrated jig is used to assemble $\frac{1}{8}$ by $\frac{3}{8}$ in. pins in $\frac{5}{16}$ in. diameter shafts with a drive fit. The pins are sheared to length and are not finished on the ends. They are dropped into chute *A*, which is a straight sided trough having the same inside diameter as the mouth of the funnel in the guide block *B*, about $\frac{5}{16}$ in. The guide hole *C* is about 0.010 in. larger than the pin.

The operator places the rod in the V-block *D* with the pin end of the rod against the stop pin *E*. He locates the hole in the shaft, which is slightly chamfered, under that in the guide block by judgment; with a pin resting on the rod, it is quite easy to align the hole. To facilitate this, the guide block *D*, is bevelled away almost to the guide hole as at *G*. The pins slide into the guide block with no trouble from lodging crosswise.

To assemble these pins with a hammer and V-block,



This jig assembles $\frac{1}{8}x\frac{3}{8}$ in. pin in $\frac{5}{16}$ in. diameter shaft at a production rate of 750 pieces per hour

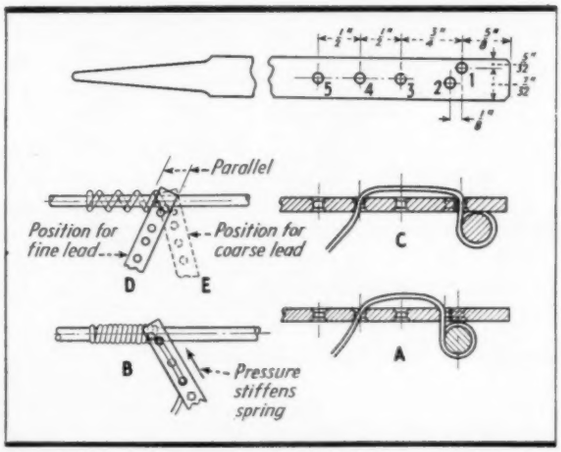
was found impractical, since the pins are too short to hold between the fingers. With this jig, it was not found possible to use any sort of aligning device for the holes in the work and fixture, that is, for aligning them circumferentially. But an operator can judge such alignment quite readily. Production with the jig is 750 pieces per hour.

Spring Winding Tool Controls Lead and Tension

By MAX O. HAAS

When winding a spring on a lathe arbor, it is often difficult to control the lead of the spring and the tension of the wire. The illustrated holder was designed to control these factors.

It consists of a flat piece of tool steel $\frac{3}{16}$ in. thick,



Open- or closed-coil springs can be wound on an arbor in a lathe with this tool, which is designed to control the tension of the wire and the lead of the spring over wide ranges

$\frac{1}{2}$ in. wide and 6 in. long; the tool shown is for wire smaller than $\frac{1}{8}$ in. One end is shaped to fit a file handle. The other end is left square and has five $\frac{1}{8}$-in. holes drilled through it; they are chamfered on both sides. Holes Nos. 1 and 2 nearest the end are for feeding the wire and governing the lead, while holes Nos. 3, 4 and 5 are for controlling the tension of the wire.

The diameter of the spring is determined by the size of the wire or arbor over which the spring is wound; however, by increasing the tension of the spring wire, a smaller size spring will result. The reverse is true if the tension is decreased. For low tension, feed the wire through hole No. 5 from underneath. Use hole No. 4 for lighter wire; for higher tension feed through holes Nos. 4 or 3. Then feed the wire down through holes Nos. 2 or 1 according to the kind of lead in the spring. For close winding, feed through hole No. 2. Very fine wire may have to be looped through three holes in order to build up enough tension.

When winding closed-coil springs, let the tool ride on top the already wound part as at *A* and hold it at an angle against the spring, as at *B*. Pressure against the arbor and parallel with the tool will determine the stiffness of the spring.

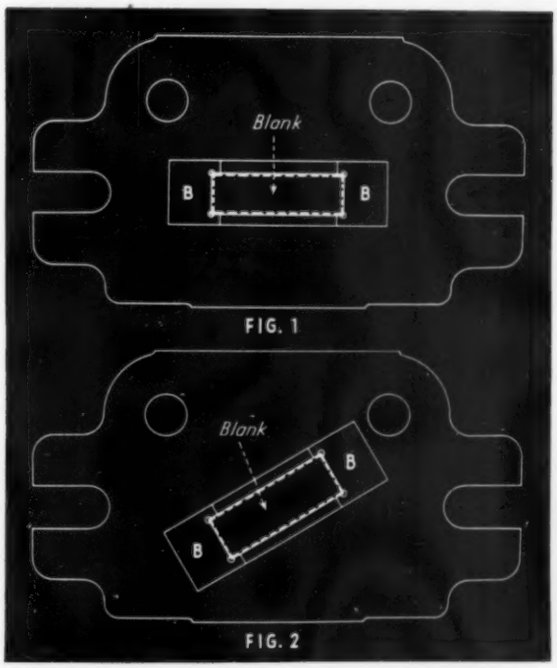
Open-coil springs are wound by letting the tool ride directly on the arbor against the last wound coil of the spring as at *C*. The finest lead is obtained by feeding the wire through hole No. 1. The next finest by using the tool upside down and feeding through hole No. 2. Using hole No. 2 from the other side or hole No. 1 upside down will give even greater leads. In between these the lead may be governed by the angle at which the tool is held as at *D* and *E*. With the tool held parallel with the coils, the lead will be smallest, while holding the tool at right angles with the arbor, or even beyond that, will increase the lead of the spring. Thus, one tool can be used for a variety of leads. The principle can be applied to all sizes of wire.

The wire is started by placing it in a hole drilled through the arbor and clamping it between the arbor and one of the chuck jaws.

Correct Layout for Second-Operation Dies

By A. D. MUNDY

One of the common mistakes which occur in laying out dies for second-operation work is the placing of the die on the die shoe parallel with the front of the shoe. Before laying out a die for this class of work, pick up the piece and try to place it in the nest *BB* as shown in Fig. 1; then try the same piece in the



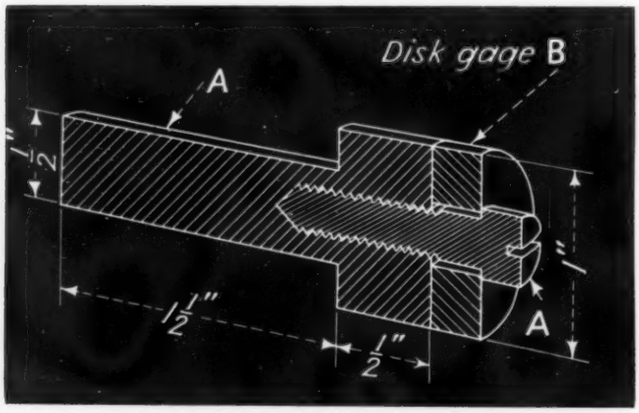
For convenient operation, second-operation die should be placed on the die shoe as shown in Fig. 2, instead of parallel with the front of the shoe as shown in Fig. 1

nest as shown in Fig. 2. It is obvious that Fig. 2 is much easier as it is so located that the operator's arm in its natural position falls in line with the nest. One of the best proofs of this is that after an operator has used a die laid out like Fig. 2, he will ask to have dies which are laid out like Fig. 1 set up at an angle on the bed plate of the press for more convenient handling of the work.

Drill Chuck Attachment for Spacing Holes

By EDWIN N. OLSON

Toolmakers are often required to drill accurately spaced holes on a drill press and while various methods are used I find that the illustrated drill chuck attachment is very useful. A piece of tool steel *A* is made to the dimensions shown in the drawing. The filister-head screw *A* must be a diameter smaller than



Holes can be spaced and drilled accurately with this drill-chuck attachment, which includes a disk gage held in place by a filister-head screw. After the first hole has been drilled, the next hole can be located with the aid of micrometers

the hole of the disk gage *B* so that the gage can be made to run true in the chuck. Toolmakers have access to micrometer disk gages which can be used for this purpose.

Assuming that the first hole has already been drilled we now proceed to make adjustments for other holes. After the chuck attachment has been made to run perfectly true in the drill chuck and filister screw has been tightened against gage, calculate the proper distance for the next hole, using micrometers. After all is set, affix job firmly to drill press table, center drill, drill and ream the hole.

This method will give surprisingly good results and will not be of the hit and miss type when trying to follow a layout or even heighth gage lines. There must be sufficient clearance between the screw and the hole in the disk gage so that disk will be allowed to "float" to its perfect running position. Using tool steel, this attachment can be hardened and be of service for many years.

Easily Loaded Hand-Milling Fixture

By F. SCRIBER

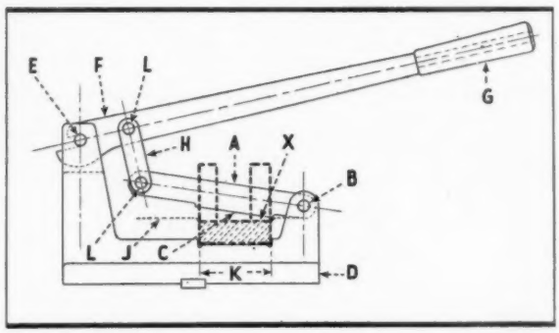
A hand-milling machine a fixture having a clamping feature that holds the work by hand while the milling operation is performed is illustrated. The clamping device is constructed so that the clamping units can be swung clear of the fixture while the work is put in place.

The work indicated at *X* has raised lugs at both ends while the central portion is rectangular as shown in section. The function of the clamp *A* is to pivot about pin *B* as a fulcrum and to bind the work by means of the finished portion *C* when the clamp is in the down position as shown by the dot and dash lines at *J*.

The base *D* of the fixture is grooved to receive the work at *K*, and at *E* is a pin passing through two raised bosses having a space between them. An open-ended lever *F* hooks around this pin while the operator takes hold of the handle at *G*. Connecting the hand lever and the clamp *A* is a link *H* attached at *L* by means of two pins.

In the position shown, the operator holds down handle *G*, thereby bringing down clamp *A* and holding the work in place while he moves the table traversing lever of the hand-milling machine to make a light cut on the end of the work.

After completing the cut it is only necessary for



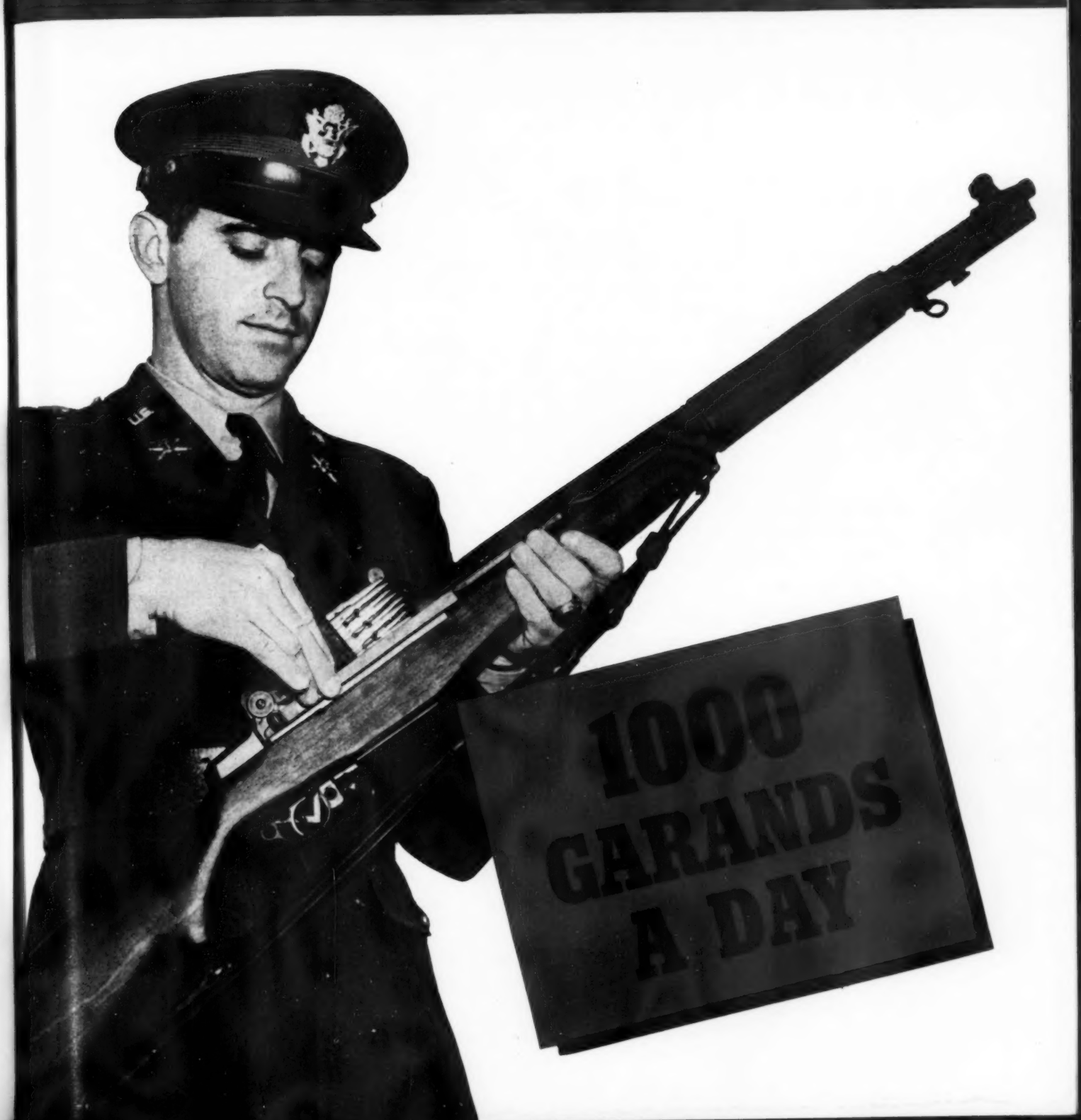
This clamping device for a hand-milling fixture permits the clamping unit to be swung clear of the fixture while the work is put in place

the operator to pull back hand lever *F* clear of the pin *E* when the entire clamping arrangement can be pulled back clear of the fixture, about pin *B* as a center, so that the work *X* may be removed without interference from any part of the fixture.

When the work is put in position on the fixture the hand lever is pushed forward to the left, thereby throwing the clamp over the work, while with the same action the handle is hooked under pin *E* so that pressing down on the handle clamps the work. It is necessary to hold the lever down to clamp the work during the entire time the milling cutter is in contact with the work; the leverage and recessed base holds the piece firmly during the short cut.

Armament

SECTION OF AMERICAN MACHINIST



1000 GARANDS

IT IS NO LONGER NEWS that the United States army has adopted a new shoulder arm, officially the U. S. 30R M1, but popularly known as the Garand after its toolmaker-inventor John C. Garand, a civilian employee of the Springfield Armory. What is news is that production of the weapons at Springfield Armory is proceeding satisfactorily with the objective of 1,000 a day early in 1941.

Thanks to Mr. Garand's years of painstaking development, the U. S. doughboy will be equipped with a rifle that has no bolt action requiring manual operation. He will be able to fire eight aimed shots without taking his eye off the target, and his average firing rate will be some 2½ times faster than with the old Springfield. All the soldier has to do is to squeeze the trigger for each shot since the rifle's action is semi-automatic. Its light recoil or "kick" is another feature that facilitates his aim.

The first Garands were literally hand-made. It took Mr. Garand and eighteen toolmakers about two years to turn out the initial lot of 80. Then larger quantities were manufactured on the Armory's old equipment that had formerly been used for making the Springfield rifle.

Since then great strides have been made in putting the rifle into mass production, both at the Armory and in plants of private manufacturers working under government orders. This story will show how the best thought of the Armory personnel, machine tool builders and small tool suppliers has gone into the 1,500 separate operations required to make a Garand rifle.

Only two years ago, Springfield Armory was struggling along with antiquated equipment. Few machines had been acquired since the World War, many were of Spanish-American War vintage and a few units dated back to Civil War days. An article published early last year (*AM*—Vol. 83, page 48a) showed that, at that time, three quarters of the equipment in Springfield Armory was over twenty years old.

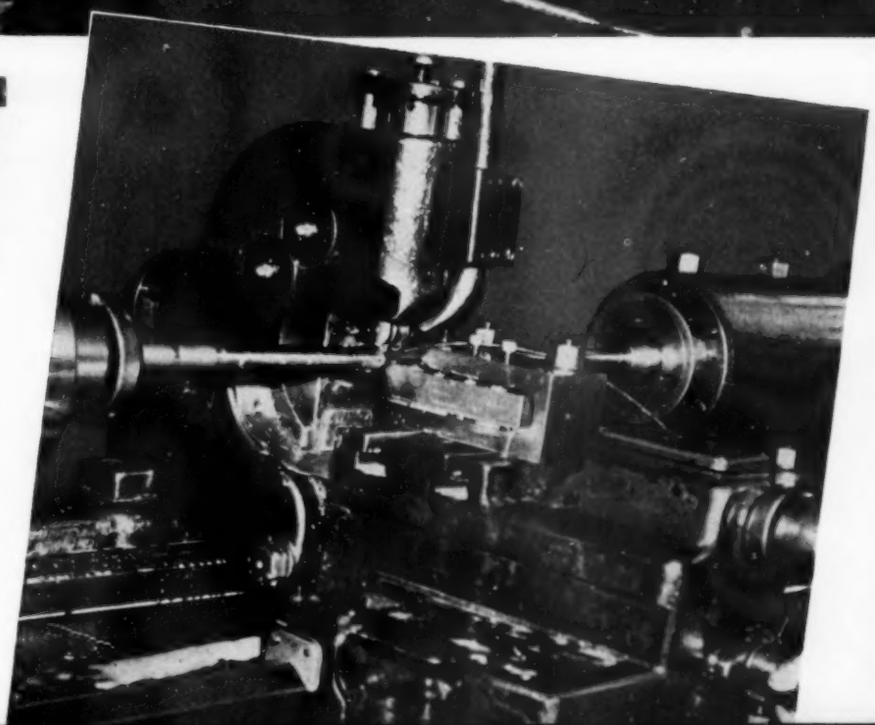
Today all this is changed. Modern machines hum away on Garand rifle parts using modern cutting tools, multiple cuts and the many other developments in mass production that the machine tool industry has been able to devise. In fact, the Armory has pioneered many methods in advance of those found in private practice.

For instance, its application of surface broaching to light parts is outstanding. It has also adopted drawn steel bars of special shape for many rifle parts, thus avoiding literally dozens of machining operations. It has utilized precision coining in the manufacture of certain components which were formerly machined all over at considerable expense. And it has applied the principles of progressive automatic die work to some of its sheet metal parts.

Probably no industry has been so steeped in tradition as that of rifle manufacture. The rifle is said to be the first product to use interchangeable manufacture; but having been the subject of this early advance in manufacturing technique, the old methods persisted until the current revolutionary changes were put to use. Until recently rifle parts

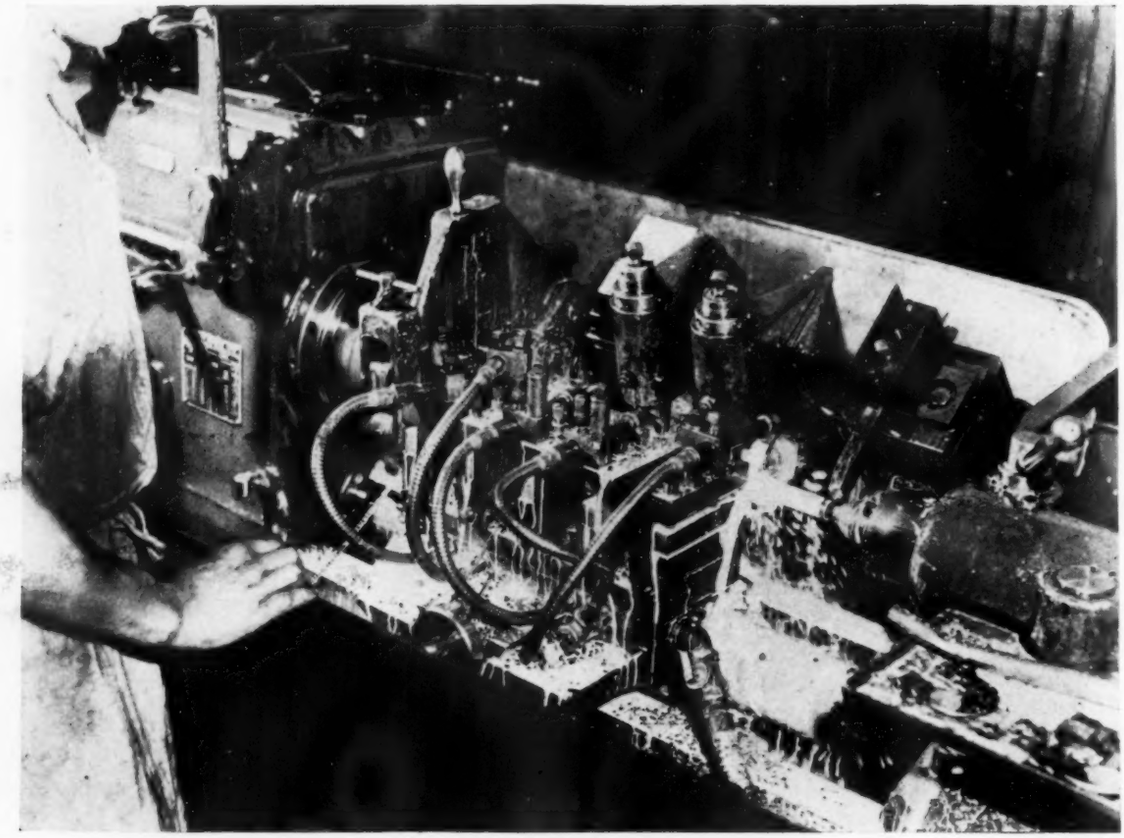
A Baush twelve-spinde special machine is used for rough reaming the bores. Each barrel is clamped in a slide and pulled upward hydraulically over the revolving tool. Each spindle is controlled independently by push-button

S *a* DAY



The barrel is finished turned on the taper section in a Speedcut lathe using a forming bar at the back of the machine to guide the tool. Note the heavy roller backrest to preserve wall thickness by preventing deflection during this cut

1000 GARANDS A DAY



Rough operations on the Garand rifle barrel are performed in a Fay automatic lathe. Here five tools are taking a longitudinal cut at the front of the machine, while two tools are used on the backrest for shouldering and chamfering

practically without exception were made by a tedious succession of single machine cuts supplemented by hand operations. The contrast with present methods makes the new set-up all the more dramatic.

The Garand rifle has some 72 parts; since the machine operations on these parts range from 1 to over a 100, it would take a good-sized volume to describe them all in detail. In order to exemplify the methods employed, certain of the rifle parts have been selected for description; these reflect the wide variety of work used in rifle manufacture and show some of the methods developed at Springfield. The parts chosen for such description are the barrel, the rear sight base, the follower slide, the safety and the front hand guard ferrule.

The barrel is made from chromium-molybdenum steel (SAE 4150) heat-treated at the supplier's plant to 269-311 Brinell hardness. This steel is selected for good strength at moderately high temperatures; also even though of high strength, it has reasonably good machining properties.

OPERATION SHEET—Rifle Barrel. 1¼-in. dia. steel, SAE 4150

Grind spots for Brinell impression.

Make and record Brinell impression (269 to 311).

Cut to working length 24.200 — 0.010 in. and center ends.

Stamp stock mark on end of stock opposite Brinell mark; end with stock mark to be muzzle end.

Spin on rolls and straighten stock to max. runout 1/32 in. 3½ in. from end of barrel, opposite stock marked end, grind rest spot.

8 in. from end of barrel (opposite end to center rest spot) grind two roll rest spots.

Turn muzzle end 0.895 — 0.020 in. tapered to 1.00 — 0.020 in. at end of cut shoulder of which is 6⅜ — ⅛ in. from breech end; chamfer muzzle.

Turn end opposite to stock mark to 1.355 — 0.01 in.; from ⅞ in. R. to 0.875 — 0.010 dia.; turn 0.875 — 0.010 dia. straight to 10.237 in. — 0.020 in. from breech end; chamfer breech end.

Spin on centers and straighten to max. runout of 1/64 in.

Inspect 100% (Magnaflux) (after rough turn operation for imperfections in stock construction).

Ream bore to 0.295 + 0.001 in. (Start reamer at breech).

C'sink both ends simultaneously 0.250 — 0.0075 over 0.375 in. ball in muzzle end, c'sink to end of barrel and 0.250 — 0.0075 over 0.375 in. ball in breech end, c'sink to end of barrel.

Spot grind, rest spot for back roll rest 9 3/16 in. from muzzle end.

Turn taper from 0.6751-0.005 in. muzzle end to 0.850-0.01 in. located 6⅛ — 1/16 in. from breech end (To remove surplus stock only).

Wash.

Line straighten bore.

Spot grind rest spot.

Turn major thread dia. rough (breech end) 0.985 — 0.005 in. square gage tenon shoulder and 0.975 — 0.003 in. dia. at 1.130 — 0.005 in. dia. shoulder; turn muzzle end 0.625 — 0.005 in dia.

Line straighten.

Spot grind muzzle end, rear of gas cyl. bearing 0.599 — 0.005 in. dia.

Turn taper sections from 0.637 — 0.005 in. dia. located 17.400 in. from breech end thread shoulder to 0.700 — 0.016 in. dia. at lower band bearing, and 0.770 — 0.005 in. at lower band bearing location up to and including ± ¼ in. radius.

Line straighten.

Turn muzzle end 0.540 — 0.005 in. and 0.5613 — 0.0054 in. major thread dia.; form groove.

Burr bore on muzzle and breech end of barrel to permit free entrance for centers.

Chamfer 30° angle on both sides of 9/16-32 P. thd. and form 45° angle on end of gas cyl. bearing.

Finish face gas cylinder lock seat and shoulder of thread.

Grind breech end to 1.115 — 0.001 in. dia. (rough).

Mill thread on breech end and tenon dia., topping nob to produce no larger than 0.972 in. major dia. of thread, 0.917 — 0.002 in. tenon dia., and 0.913 — 0.005 in. dia.

Form mill top (rough and finish) two at a time.

Wash.

Stamp stock mark and piecemark on stock.

Line straighten.

Grind lower band bearing 0.726 — 0.002 in. dia.

Mill rear hand guard grooves (R & L).

Ring straighten.

Spot grind 0.628 — 0.005 in. dia.

Grind muzzle end (finish) 0.514 — 0.002 in. dia.

Finish grind breech end 1.100 — 0.001 in. dia.

Grind 1 + ¼ in. radius.

Grind gas cylinder bearing 0.660 — 0.001 in. dia.

Mill three cuts for gas cylinder splines, symmetrical and concentric.

Ream chamber (rough) and c'sink breech end 45° to remove surplus stock on breech end of barrel.

Wash.

Rough and finish ramp including 0.01 R + 0.01 in.

Ream bore 0.298 + 0.001 in. dia. (Cut ream oper.) Start reamer at breech end.

Wash.

Ring straighten.

Ream bore (finish) 0.300 +0.001 in.

Wash.

Rifle bore (hook cut).

Ream chamber (finish) (Cut reamers only used).

Wash.

Broach lower band pin retaining slot.

Form 0.035 + 0.005 R at intersection of ramp and chamber.

Form 0.020 R + 0.005 in. at mouth of ramp.

Mill bullet nose clearance cuts.

Cut thread muzzle end.

C'sink, face and chamfer muzzle end of barrel to finished length 23.310 — 0.01 in.

Hone chamber.

Wash.

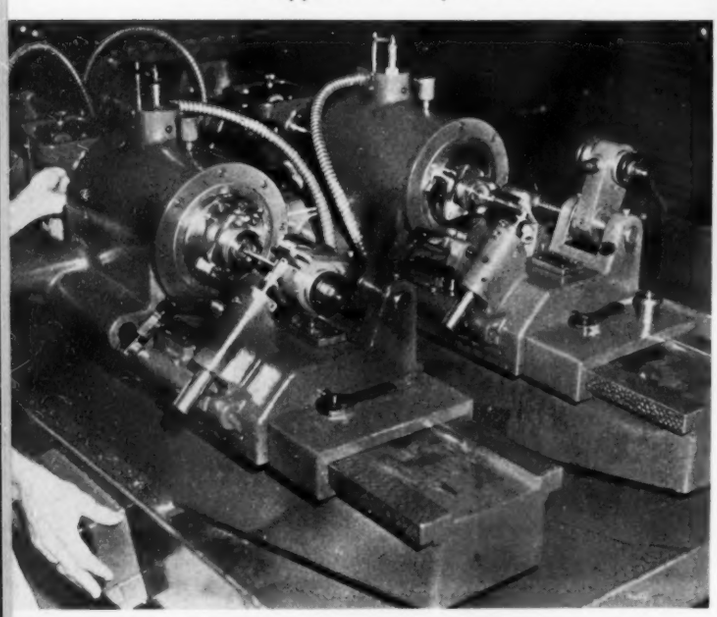
Mark manufacturer's initials, month of year and year of manufacture.

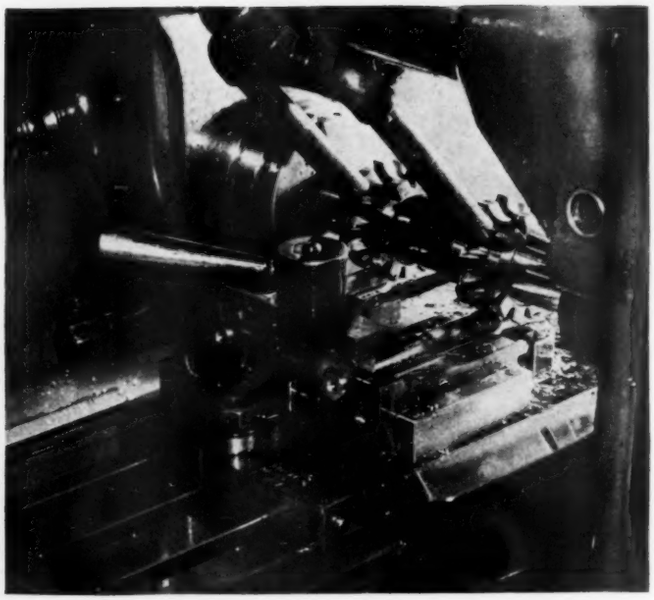
An operation sheet is given for the rifle barrel. It will be noted, that the number of steps is relatively great; this is because of the need at all times of maintaining a uniform wall thickness. The rough barrel forging weighs approximately eight pounds while the finished part weighs only 2½ pounds. As is well known, the removal of any great amount of metal from a long, slender piece of this kind tends to distort it. For this reason, frequent straightening operations are required so that when the next step it taken in machining, the wall thickness will remain uniform.

There are two general methods employed at Springfield Armory for inspecting and correcting bore straightness: the line method and the ring method. The line method is quicker but can be used only before the bore is rifled. The ring method can be used before or after rifling; it is somewhat slower, requires greater skill but is extremely accurate.

In the line method, the inspector holds the barrel in a screw jack and sights through the bore at a straight line scribed on a ground

This is the end of an Ex-Cell-O barrel rifling machine which controls the radial speed of the cutters. The cutter bar is rotated while a fixed socket holds stationary a nut at the end of the bar, thus setting up a tapered pin which pushes the cutters outward. The helical motion of the bars is controlled by precision guide screws at the opposite end of the machine





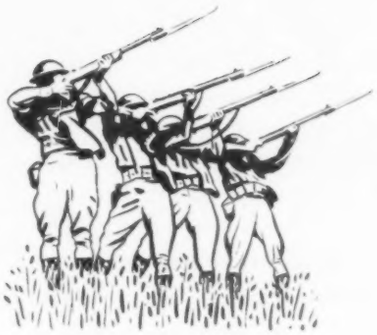
The top of the barrel is form milled in this double fixture using an equalizing clamp on a Brown & Sharpe milling machine

glass window some 20 ft. away. With his eye slightly above the center of the bore, he looks downward to see the reflection of this line in the bore's reamed surface. If the bore is straight, the line looks like two converging railroad tracks running about half the length of the barrel. A long curve indicates a gradual bend in the bore. A short kink indicates a sharp bend. The barrel is revolved and inspected from both the muzzle and the breech end. When the curves or kinks appear, they are removed by applying the jackscrew. Where to apply pressure and how much is a matter of experience.

In the ring test a painted glass cap, upon which a ring has been scribed to let the light through, is placed over the end of the bore. The light is reflected again and again to form a series of rings along half the length of the barrel, magnifying any irregularities. Out of roundness or lack of concentricity in the rings means that the bore is bowed or kinked. The barrel is rotated on rollers and inspected from both ends. Straightening is done with a copper hammer. Again the inspector has to learn where to hit and how hard.

Both line and ring tests have a high degree of accuracy and are repeated in the course of barrel manufacture to prevent variation in wall thickness. Otherwise a "walking" barrel will result; that is, the heating of the barrel when fired will result in uneven expansion, causing the barrel to "walk off" the target.

While many of the rifle barrel operations are familiar in machine shop practice, they represent a departure from older methods of making these parts. For instance, turning is now done on automatic lathes of the Fay type. In the first rough turning operation which takes cuts on the muzzle end, five turning tools are used at the front of the machine while two additional tools are used at the back for



Because of the fact that rifle reaming is a critical and delicate operation, the cutting edges of the tools must be lapped. These two fixtures, one for the outer radius and one for the cutter face are used to hold these tools while lapping

facing a shoulder and chamfering the muzzle. Cemented carbide tools have been found to speed production.

It will be noted, too, that after the barrel has been rough machined at both ends a 100 per cent Magnaflux inspection is used. The employment of this magnetic method of testing so early in the process shows up any flaws before a large amount of work has been done on the barrel.

More specialized are the operations for drilling, reaming and rifling the bore. For drilling a hollow, single-fluted drill is used which consists of a high-speed steel tip welded to formed seamless tubing. Coolant forced through the drill keeps down the temperature at the tip and washes the chips out of the bore. The barrel is rotated while the drill is fed from the breech end. Size is held to plus 0.0015 in.

Reaming is done in two steps. A newly designed vertical machine in which the tools are rotated while the barrels are fed upward over them, performs the rough reaming. This machine has twelve spindles each of which is independently push-button controlled. The feed is hydraulic.

After rough reaming, both ends of the barrel are countersunk to provide new centers. The depth of countersink is checked by measurement over 3/8-in. steel balls.

Finish reaming and rifling are done in horizontal machines. For these operations particular attention is paid to tool sharpening. The reamer, for instance, is ground dry on a standard tool and cutter grinder with a grit wheel. Then without changing the set-up, a new extremely fine grit wheel with a shellac bond is used, to remove 0.001-in. of metal at the rate of 0.0002 in. per pass. The next step is to lap with oil and a fine lapping powder by hand using a piece of old gun barrel.

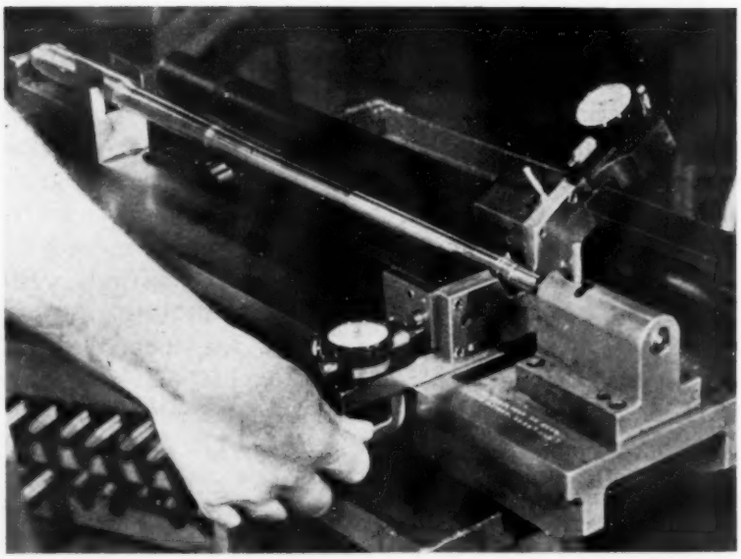
Finally the reamer is honed using triangular sticks of fine India or silicon carbide.

Hooked cutters are now used entirely for rifling at the Springfield Armory. These are somewhat sturdier and give increased production over the older feather-edged cutters. They must be accurately ground and stoned if they are to give the smoothly finished grooves which are so essential. These cutters are sharpened by a method closely paralleling that used for the reamer. For the hand honing operation, special fixtures are used. While held in a bar, such as used in the rifling machine, the cutters are rotated under the honing stone to give a smooth finish to the outside radius. A second fixture holds the cutter at the correct angle while the stone is worked back and forth to finish sharpen the face. Cutting angles are important.

Since rifling is done only in one direction, a special device is used to withdraw the cutters into the bar at the end of the cutting stroke. At the opposite end of the stroke, the cutter bar strikes a stop which again expands the cutters into operating position. In addition a nut at the end of the bar enters a recess which rotates a tapered plug to increase the depth of cut. This feed of the cutters is done at every other stroke of the rifling tool. The rifling grooves have a depth of 0.004 in. and a twist of one turn in ten inches or approximately two turns in the length of the barrel. Pratt & Whitney and Ex-Cell-O rifling machines are used.

Bore and grooves must be absolutely smooth and within a tolerance of 0.001 in. Dimensions of both are inspected at every inch along the length of the barrel by means of star gages. These gages have expanding fingers which give readings on a vernier micrometer at the end of a long rod. It has been found at Springfield Armory that it is advisable to add a spring to the star gage to give uniform pressure when expanding the measuring points, thus eliminating variations caused by the inspector's touch.

Another set of operations that calls for care is the chambering of the breech end. These operations are done in a machine with a vertical turret having a series of nine tools. Rough boring and reaming are done prior to the reaming of the bore while finish chamber reaming is done afterward. The reason for such care in these operations is that the surfaces so formed provide the bullet seat. Tolerances must be held close to seal the cartridge against the force of the explosive gases and at the same time to permit free



The size and position of gas cylinder splines must be held within close limits. They are checked on this fixture with two dial indicators. The one at the left connects with two expanding contact points which register the width of the groove while that at the right measures the depth

ejection of the bullet after the rifle is fired.

Jigs and fixtures have been devised on practically all the other operations on the Garand rifle barrel. They include devices for form milling the top of the barrel, straddle milling the rear hand guard slots, cutting the gas cylinder splines and milling the bullet nose clearance. Each of these fixtures has been designed to facilitate production by using multiple set-ups, quick-clamping arrangements or special indexing devices.

For form milling the top, barrels are set up two at a time in a fixture. They are supported in adjustable V-slots at either end and clamped by equalizing straps.

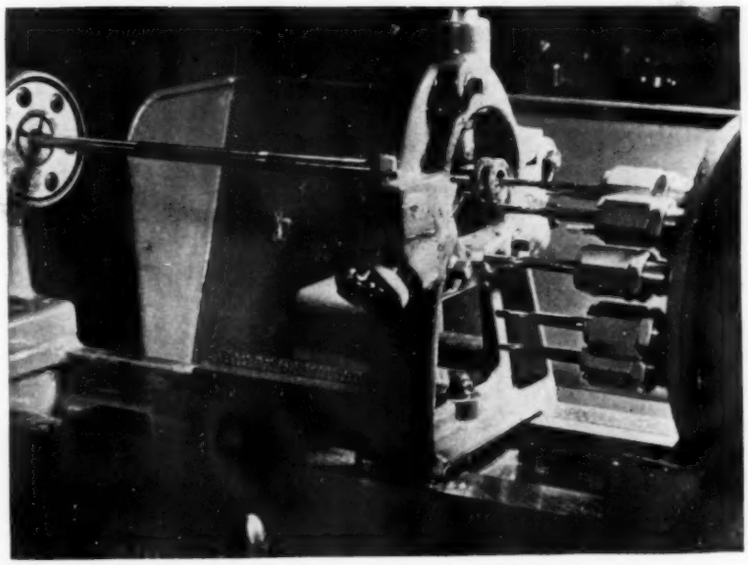
Roller toggles are used to clamp the barrel for milling the rear handguard slots. Here again a double fixture is used with the work held against V-blocks by means of pivoted clamps. The clamping screws swing upward for quick release.

Each barrel has three gas-cylinder spline slots which must be accurate as to size and position. In a triple fixture, three barrels are indexed simultaneously by means of intermeshed gears and located by separate tapered lugs. The work is mounted on its centers.

To cut the bullet-nose clearance in the breech end, a special milling machine fixture is provided. By means of a rotary clamping sleeve, the work may be locked or rotated while the cut is in process. In this set-up the breech end is milled away for approximately 110-deg., and a small notch is cut in addition.

Naturally, cleanliness is essential to insure precision throughout the various operations performed on the barrel. It will be noted from the operation sheet that the barrel passes

Operations on the safety have been reduced from a multiplicity of milling and profiling operations to the simple sequence illustrated. Machining has given way to precision forging, coining, trimming and shaving

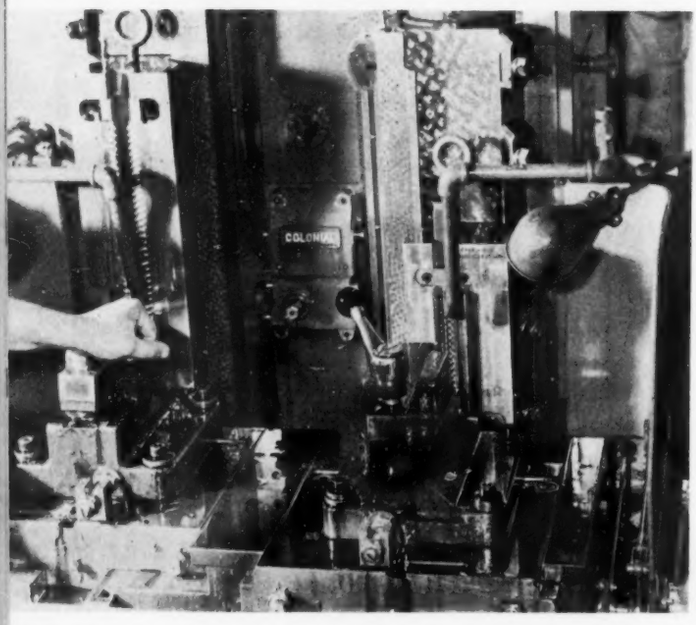


The barrel chamber consists of the surfaces that seat the cartridge, seal it against the force of explosion and still permit free ejection. It is machined in this multi-spindled Pratt & Whitney machine which cuts and reams a number of surfaces which must be accurate as to size and relative position

through numerous washings. In order to facilitate this process, a special set-up has been devised. The barrels are held in wooden racks 100 at a time. The rack is lifted and lowered by means of a hydraulic lift through four stations: loading, cleaning, rinsing and unloading. The cleaning and rinsing tanks contain soda solution and hot water respectively. The hoist is located in the center of these stations and pivots as it lifts the work in and out of the tanks. Its use avoids manual handling of the barrel during this process.

Chief interest in the rifle part, known as the safety, centers in the fact that its method of manufacture has been entirely revolutionized. While this piece is small, its many irregular contours involve troublesome operations when the piece is machined all over. Formerly it was the practice to hollow-mill the 0.197 in. pin and then rough and finish mill practically all the other surfaces using both form milling and profiling. These steps required special fixtures for each operation.

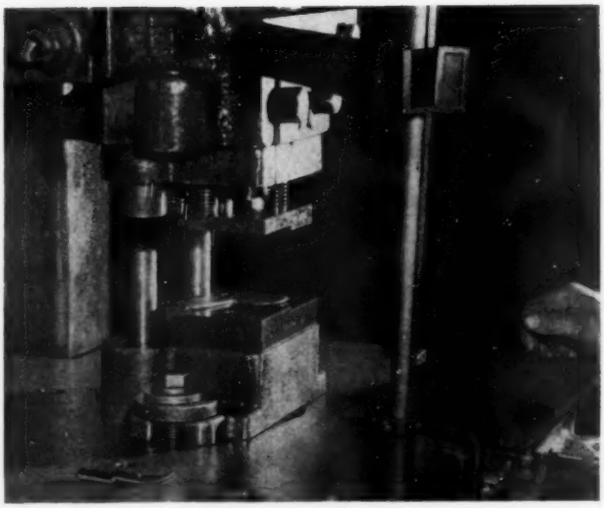
Now the safety is made without any machin-



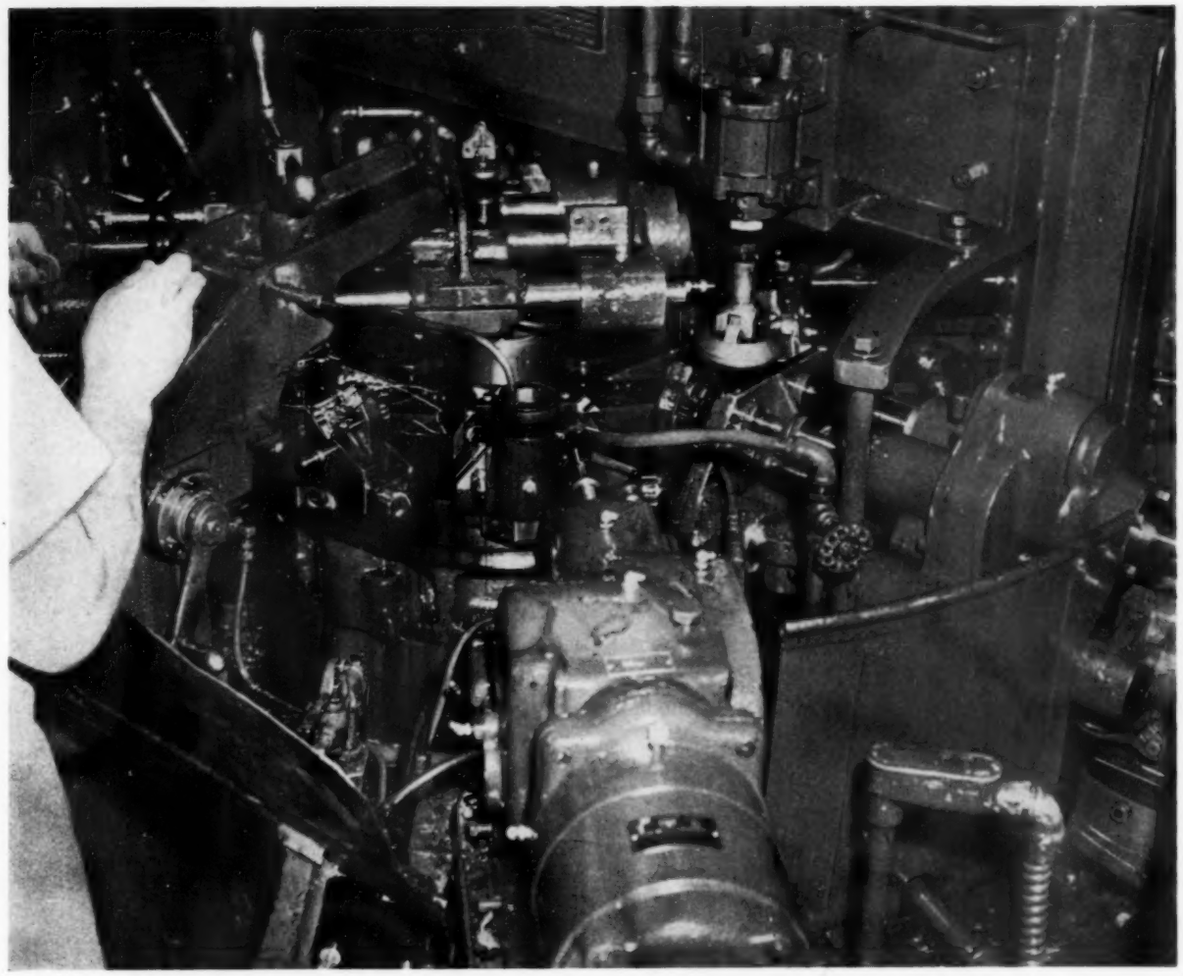
This set-up is typical of several broaching operations performed on the rear sight base. A two-ram Colonial machine is used with a pair of fixtures. That at the left trims the sides of the workpiece while that at the right cuts the radius and the under-cut

OPERATION SHEET—Base, Rear Sight. Steel forging, SAE X1340

Forge from bar at 1950-2200 F. Normalize at 1600 F. Cool in air.
Anneal at 1525 F. Adjust temp. to obtain Brinell 197-223.
Straighten and trim cold.
Broach both ends.
Broach both sides, and circular cut.
Broach bottom contour rough.
Broach top contour.
Broach sides at front end.
Drill, step ream, rough and finish hollow mill, rough tap and rough mill aperture slot.
Broach grooves and aperture slot.
Profile top and back between ears.
Profile top and back radius on ears.
Finish tap.



This is the trimming die used on the safety. The workpiece has already been forged to close limits before this operation is performed



The Kingsbury drilling machine used on the rear sight base has eight stations; two pieces are chucked in each fixture. The workpiece travels around twice being reversed after the first revolution. Auxiliary hydraulic work clamps are used at two stations where heavy cuts are taken (note overhead cylinders) because of the few surfaces available to grip the work securely. In addition to drilling, this machine roughs out the circular slot

ing operations. Instead of being forged to machining allowances, the part is made as a precision forging. A coining operation brings the piece to final thickness including the proper dimensions on the pin. Only three other steps are required, all press operations. The safety is punched to form two holes, trimmed in a die and then shaved to its final dimensions.

A step in the shaving punch used for the safety divides the shearing action, while a break-up pin cuts the surplus stock. As in other press operations, standard die sets are used wherever possible. The safety is made of a low carbon chrome-nickel steel, and is case-hardened after it leaves the press shop.

The rear sight base is selected as one of the riffle parts to which surface broaching has been effectively applied. This includes the new circular broaching which performs a difficult operation in a minimum time.

This piece is made from a free cutting medium carbon steel forging (SAE X1340). The base is odd in shape, involving as it does a number of irregular contours and circular grooves. At the same time, since it supports the rear sight, it must be machined to a high

degree of accuracy. Were it not for the use of six broaching operations, each of which cuts a series of surfaces, the machining of this part would indeed be tedious.

One of the external broaching operations is illustrated. As in many rifle part operations, a double-ram machine is used with two fixtures. In this particular set-up, one set of broaching tools cuts the radius, under-cut and top surfaces while the second set of tools, shown at the right, broaches the sides. In each case the piece is held by a clamp in a positioning fixture, while the tools operate. One ram ascends while the other descends to take the cut. Other external broaching operations on this part follow the same general method.

Two additional operations on this part deserve special comment. A Kingsbury multi-station machine drills, reams, counterbores, trepans this piece and mills the slot. Because of the fact that this part is small and three sides of it have to be machined, there is very little area left for locating and clamping. For this reason it was found necessary to put on auxiliary air clamps at the stations where the trepanning or hollow milling operations are performed. The air cylinders for these two clamps are mounted on a cross-rail which reaches across the top of the indexing turret as shown in the illustration.

Each fixture is made to hold two parts as the parts are chucked twice. In this way, once all the fixtures are loaded, a completed part is obtained at each indexing of the turret.

The circular slot is only roughed out in the Kingsbury machine. It is made into a circular T-slot by the use of a circular broaching operation done on a Krueger machine. The circular broaching tool has a final cross-section corresponding to the finished dimensions of the slot. It has also a 54-deg. gap into which the work is inserted in order to start the cut. The fixture which holds the work is mounted on two slides. One of these allows the fixture to be moved to depth; a cross-slide is used to position the work relative to the center of the cutter. After the part is clamped, a push on the starting button causes the hydraulic circuit to advance the fixture against a stop. The cutter then rotates

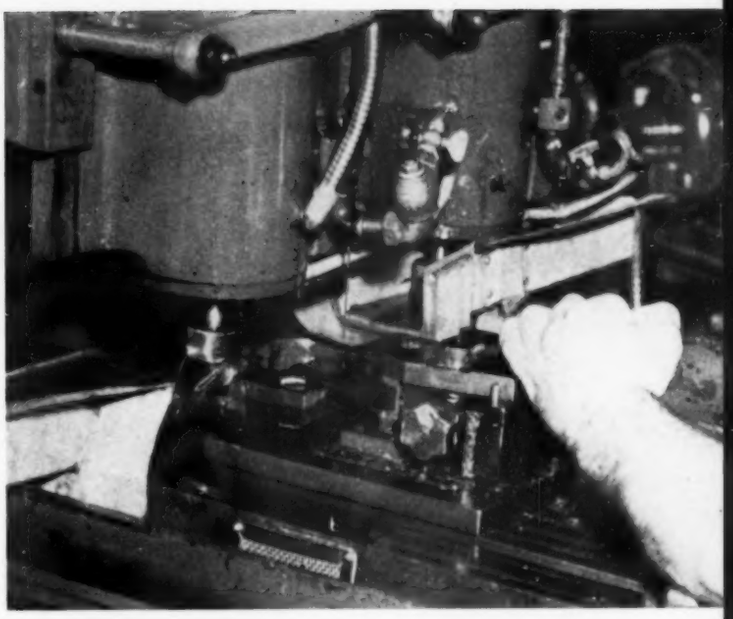
This Krueger circular broaching machine performs a difficult operation in a minimum of time. One pass of the circular cutter undercuts the circular T-slot. After the piece is clamped in place, a touch on the starter button feeds the fixture forward hydraulically, holds it during the cutting cycle, and returns it to the loading position

through a complete revolution, and the fixture is backed away. The cycle is automatic. The cutter arbor is fitted with a micro-adjustable nut so the broach can be positioned vertically relative to the work-piece. The idea for this circular broach was worked out by Armory engineers with the builders of the equipment.

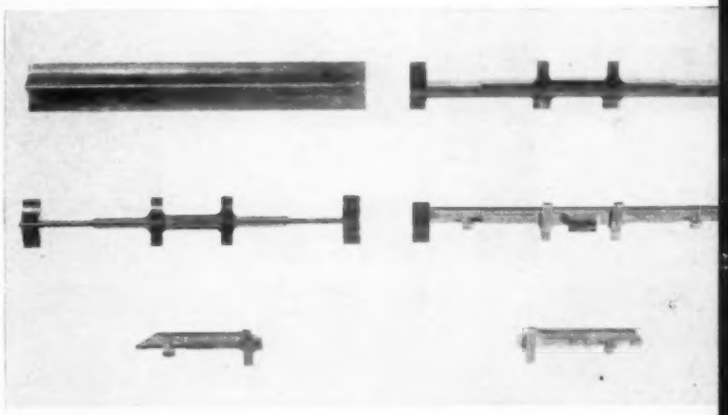
Two surfaces on the rear slide base which do not lend themselves to broaching are done by profiling. One of these steps is illustrated. The operation is to machine the radius which forms the top and back between the ears; at the same time the center mark by which the sight is set is cut in this surface. The cutter is made up of three parts; two circular cutters with a saw blade between them to mark the center. A working head follows a guide spindle in contact with a master cam of the correct contour in accordance with conventional profiling practice.

Another rifle component in which broaching plays an important part is the follower slide. But this piece has another point of interest in that it is made from cold-drawn chrome-nickel steel of special shape (SAE 3115). It will be noted that although the part is small, its many irregular surfaces would mean a multiplicity of operations if the piece had to be cut from rectangular stock. Many of these steps are eliminated by the use of the special cold drawn stock.

The illustration of the follower slide in



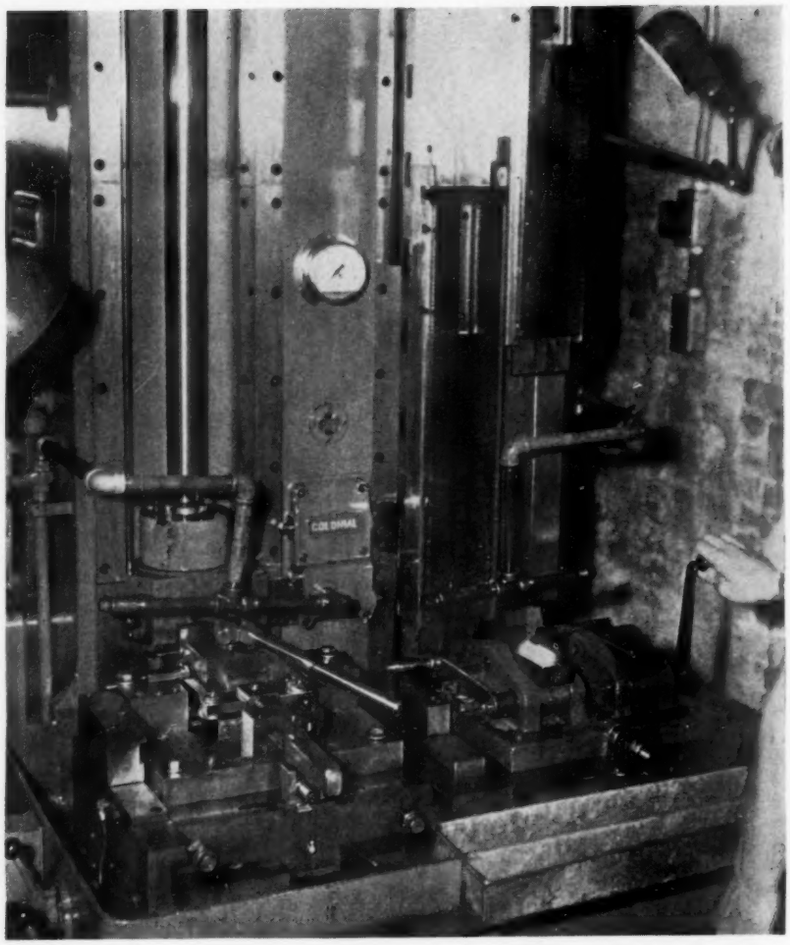
One of the two profile milling operations on the rear sight base is shown here. In this set-up the radius between the two side lugs is cut together with the saw mark for the central position. As usual in profiling, the cutter spindle follows a guide pin in contact with the master contour



The follower slide is one of several parts made economically by the use of drawn stock of special shape. Since the irregular contours are formed by the steel drawing die, the balance of the work can be done in comparatively few broaching and milling cuts. It will be noted that the piece as broached makes two of the follower slides

OPERATION SHEET
Slide, Follower.
Drawn steel, SAE 3115

Cut to length 4.962 — 0.010 in.
Strain relieve for one hr. at 800 F.
Blank both sides.
Inspect for straightness.
Broach one side.
Broach other side.
Broach bottom contour.
Mill 54° angle.
Form mill 20° angle.



A double-ram Colonial broaching machine does much of the work on the follower slide. This set-up uses a single fixture at the left and a double fixture at the right to cut surfaces in three directions

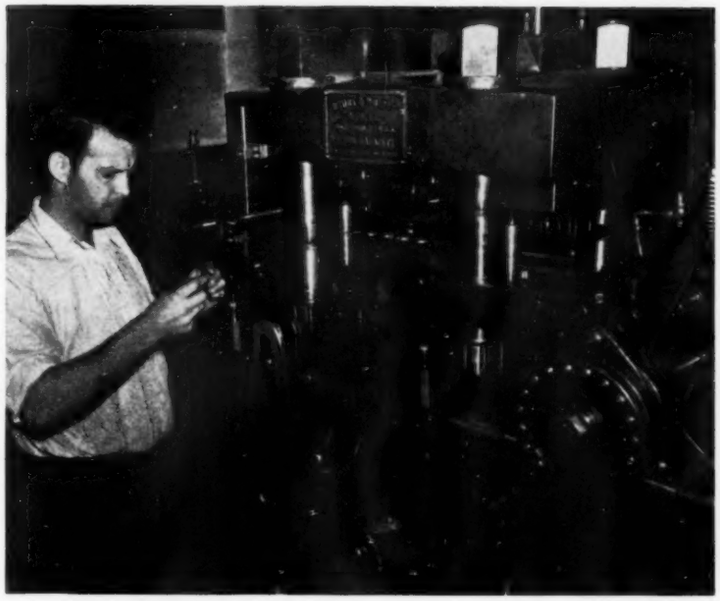
various stages of completion shows the main steps. After cutting to length by means of a rubber-bonded wheel, the stock is blanked, straightened and then broached, first on one side, then on the other and finally on the bottom. One of the broaching set-ups is shown. Here again a double-ram machine is employed using two fixtures which hold the parts; the ram on the right-hand side, carries two broaching tools for the two sides of the workpiece respectively. The fixture on this set-up has pivoted clamps operated by means of eccentrics. Each piece as broached is cut in half to make two components. The splitting is done when the 54-deg. angle is formed. Another milling machine operation cuts the 20-deg. angle which finishes the piece.

The fixture for this operation holds the follower slide while the flat 20-deg. surface and a radius are cut in it. When the upper part of the fixture strikes a stop held on the machine frame, it is forced along the base against the pressure of a spring. Meanwhile a rack acting through a pair of gears rotates the workholder to give the desired motion.

The front hand guard ferrule lends itself to progressive die work. The machine set-up as illustrated, together with a strip of the stock up to the point of shearing off, gives a very good idea of how this part is made. Although it is not part of the rifle proper, the cartridge clip is made by a similar set of tools in the same automatic dieing machine.

The operations as described above are typical of other manufacturing steps performed on other parts. For instance, special drawn

1000 GARANDS A DAY



This is the Henry & Wright machine on which the front hand guard ferrule is made. A similar set-up is used for stamping out the cartridge clips

The front hand guard ferrule is made of strip steel stock in a continuous automatic dieing machine with the sequence of operations as shown. The use of this method eliminates the many separate steps that would otherwise be required

steel stock is used on the sear, the accelerator and the ejector. Coining is used on the trigger, the follower arm and the gas cylinder as well as the safety. The barrel, of course, is unique.

Nearly all the parts in the rifle are heat-treated, following final machining. The barrel is an exception having been heat-treated in the rough.

The parts are assembled to form the finished rifle. While hand operations are used almost entirely, the procedure has been improved and simplified so as to shorten the number of steps and length of time required to put a rifle together.

After inspection the rifle is tested. First it is given a proof test which consists of an overload charge subjecting the mechanism to about a 50 per cent greater pressure than it will receive from the standard cartridge. Then the rifle is given a functioning test of 64 rounds during which any malfunction is recorded, and if present, the rifle is sent back for disassembly, inspection and correction of the trouble.

Following this, the rifle goes to the ballistic division in which it is fired for accuracy. The rifle is held on a stand, and after three warming shots to heat up the barrel, it is fired at a target. At a distance of 100 yds. five shots must fall within a 3-in. radius in order to have the rifle pass inspection.

The final test of any weapon is how it stands up in the hands of the soldier in the field. Garand rifles are now rapidly being put into service. Experience received in this way is the only good method of proving the merits of this weapon.

Continuous Hinges in 3 Steps

By J. M. LaRUE, THE CINCINNATI SHAPER COMPANY

1 WITH PROPER TOOLS, only six operations are necessary to produce both strips needed for a piano-type continuous hinge such as now is finding considerable application in aircraft construction. Some airplane builders are making these hinges of aluminum alloy, others use stainless steel. For the hinges shown in the accompanying illustration, the dimensions are the same for each material: thickness, 0.045 in.; length of hinges, 6 ft.

Each complete hinge consists of two loop-tongued and notched blanks. The tongues are 15/32 in. wide and the mating notches are 17/32 in. wide. In the finished hinge, the tongue loops are joined continuously with a 0.090 in. diameter pin. These hinges are made in four widths (when both strips are joined): 1-1/16 in., 1¼ in., 1½ in., and 2 in.

2 Only three press brake operations are required to produce each strip:

1. Notching the blank in one stroke produces the tongues.

2. The ends of the tongues are formed or coined in one stroke.

3. Curving the coined ends of the tongues in one stroke completes the loops.

The notching equipment for the first operation is shown in Fig. 1. Here, the top die consists of individual cutting punches, mounted in a bolster plate. The bottom die, in addition to mating die sections, has adjustable gages for the different widths of material, and finger strippers to remove the work from the dies. Outlets in the bolster plate upon which the die plate is mounted permit the slugs to drop through at the rear of the press brake.

3 The forming equipment for coining the ends of the tongues in the second operation is shown in Fig. 2. The lower die in this set-up has interchangeable adjustable gages for the different widths.

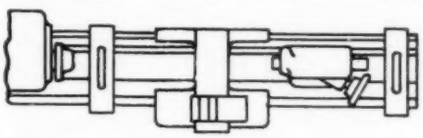
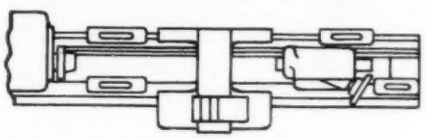
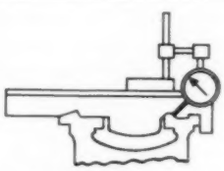
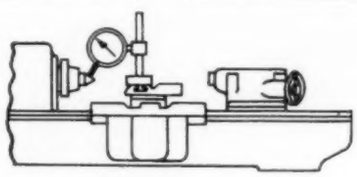
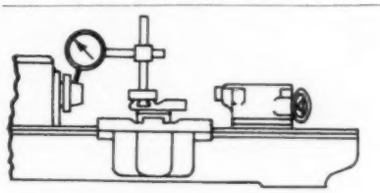
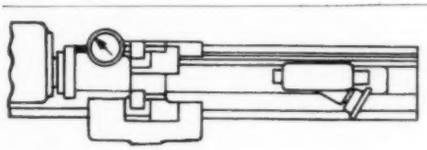
The final looping operation on the strip is shown on Fig. 3. Here, the coined ends of the tongues are curved to complete loops in one stroke of the brake. Here again simple gages are provided for handling the different widths of strip stock.

AMERICAN MACHINIST REFERENCE BOOK SHEET

Standards of Accuracy for Engine Lathes—I

Courtesy of the National Machine Tool Builders' Association

THE FOLLOWING standards of accuracy were drawn up and adopted by the builders of engine lathes, members of the National Machine Tool Builders' Association. The standards give tolerances to which the industry is building toolroom and engine lathes, and tests by which the tolerances may be checked. *(To be continued)*

TEST	RECOMMENDED STANDARDS		
	Toolroom lathes	12 to 18 in. engine lathes	20 to 36 in. engine lathes
 *Bed level, transverse direction*	When using precision level, both readings to be within 0.0005 in. in 12 in.	When using precision level, both readings to be within 0.0005 in. in 12 in.	When using precision level, both readings to be within 0.001 in. in 12 in.
 *Bed level, longitudinal direction*	When using precision level along bed, maximum reading to be within 0.0005 in. in 12 in.	When using precision level along bed, maximum reading to be within 0.0005 in. in 12 in.	When using precision level along bed, maximum reading to be within 0.001 in. in 12 in.
 *Tailstock way alignment*	Maximum reading along length of bed, 0.0005 in. in 48 in.	Maximum reading along length of bed, 0.00075 in. in 48 in.	Maximum reading along length of bed, 0.001 in. in 48 in.
 *Spindle center run-out*	Total indicator reading, 0 to 0.0004 in.	Total indicator reading, 0 to 0.0005 in.	Total indicator reading, 0 to 0.00075 in.
 *Spindle nose run-out*	Total indicator reading, 0 to 0.0003 in.	Total indicator reading, 0 to 0.0004 in.	Total indicator reading, 0 to 0.0006 in.
 *Cam action of spindle*	Total indicator reading with indicator on rear side of test plate, 0 to 0.0003 in.	Total indicator reading with indicator on rear side of test plate, 0 to 0.0005 in.	Total indicator reading with indicator on rear side of test plate, 0 to 0.00075 in.

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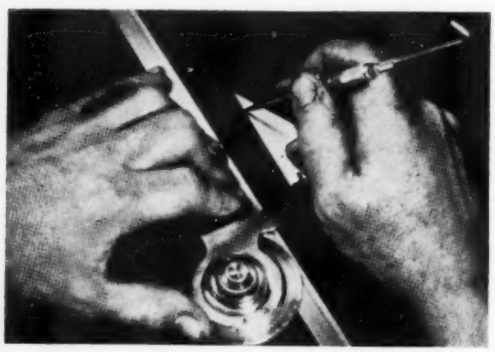

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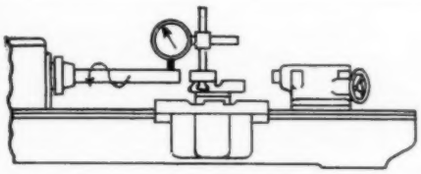
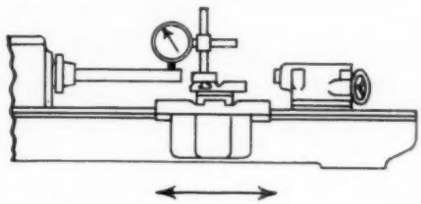
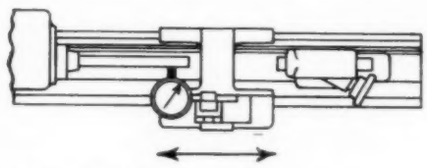
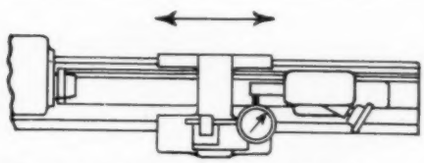
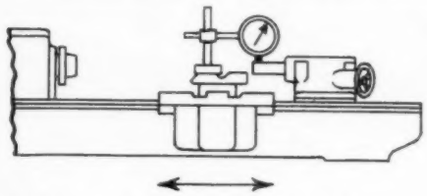
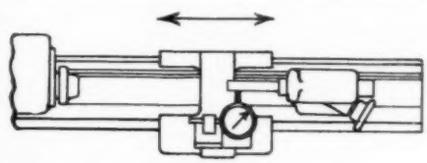
AMERICAN MACHINIST REFERENCE BOOK SHEET

Standards of Accuracy for Engine Lathes—I

TEST	RECOMMENDED STANDARDS		
	Toolroom lathes	12 to 18 in. engine lathes	20 to 36 in. engine lathes
 *Spindle taper run-out*	Total indicator reading at end of 12-in. test bar, 0 to 0.0006 in.; at end of spindle nose, 0 to 0.0003	Total indicator reading at end of 12-in. test bar, 0 to 0.0008 in.; at end of spindle nose, 0 to 0.0004	Total indicator reading at end of 12-in. test bar, 0 to 0.00125 in.; at end of spindle nose, 0 to 0.0006
 *Headstock alignment, vertical*	High at end of 12-in. test bar, 0 to 0.0005 in.	High at end of 12-in. test bar, 0 to 0.0001 in.	High at end of 12-in. test bar, 0 to 0.001 in.
 *Headstock alignment, horizontal*	At end of 12-in. test bar, 0 to ±0.0003 in.	At end of 12-in. test bar, 0 to ±0.0005 in.	At end of 12-in. test bar, 0 to ±0.0008 in.
 *Tailstock spindle alignment, horizontal*	Forward at end of spindle when fully extended, 0 to 0.0005 in.	Forward at end of spindle when fully extended, 0 to 0.0005 in.	Forward at end of spindle when fully extended 0 to 0.0005 in.
 *Tailstock spindle alignment, vertical*	High at end of spindle when fully extended, 0 to 0.0005 in.	High at end of spindle when fully extended, 0 to 0.0008 in.	High at end of spindle when fully extended, 0 to 0.0015 in.
 *Tailstock taper alignment, horizontal*	End of 12-in. test bar, 0 to ±0.0005 in.	End of 12-in. test bar, 0 to ±0.0008 in.	End of 12-in. test bar, 0 to ±0.0015 in.

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Subcontracting Speeds Defense

UNCLE SAM has cut out for himself the biggest peacetime job in his career. He intends to raise, train and equip an army of 1,200,000 men and to have on hand the equipment for an additional 800,000 men by April 1, 1942.

That date sounds like a long way off, but actually it is less than seventeen months distant. To start from scratch to produce such a huge supply of armaments by then—airplanes, ships, tanks, guns, shell—is a task to make the most efficient shop leader cross his fingers hoping there will be no slip-up.

To do that task as quickly as possible is the program immediately ahead of industry. If the time schedule is to be met, it appears to us that two courses are necessary.

First, new plants and new production lines must be created and equipped without delay. But to say "without delay" doesn't mean it can be done next week or next month. By the nature of mass production, tooling up is a tedious and painful process. He who expects to see automobiles come off the lines today and tanks tomorrow is profoundly ignorant of mass production industries. As Alfred P. Sloan, Jr., has said, "At the best a year is needed between the inception of a defense project and production, months more to develop the maximum capacity and efficiency."

Though nothing can stop the United States from out-producing everybody else in the world in short order after things start rolling, there is no reason to sit and twiddle our thumbs while we watch the new plants going up and the new machinery being installed. That brings us to the second course to be followed in the speeding up of our program for armament manufacture.

The subcontracting system, the method of farming out just as much work as possible, should be utilized to the fullest extent. Parts production can be distributed through the community and the district and the nation.

In this manner idle or partially active plant capacity can immediately be put to maximum use. Machine tool and other factory equipment already in place can be put to work. More people will be employed, payrolls will be spread wider and economic stimulation will be more greatly diffused.

Some people in Washington figured that in a national emergency the thing to do would be physically to transfer machinery from an idle plant to another company straining to get out more production than its capacity could handle. How much more sensible, and how much less dislocation will occur, if the machinery stays where it is and the idle plant is given a subcontract. The same purpose will be accomplished more rapidly and more efficiently.

Subcontracting defense work on a big scale already has proved its worth. It has been tried successfully in the aircraft industry; Boeing employs 360 subcontractors in making the Flying Fortress. It has been tried successfully in the machine tool industry; one company alone has 72 outside shops working for it.

The subcontracting system isn't a cure-all for defense delays. But it is a relatively simple and effective way of putting men and machines to work for Uncle Sam with the least delay when minutes and hours and days are precious. Let's use it to the greatest possible extent.

Burnham Finney

GAGING BUSINESS

Machine tool production is double that of year ago. Expansion of plant capacity is large. Big awards are made of ammunition components. Steel consumers reported laying in more tonnage.

Tooling of existing metal-working plants and construction of new factories to expedite manufacture of armament for the U. S. defense program are proceeding at a record pace. Meanwhile production is being quickened and employment increased as the Army and Navy place orders of unprecedented peacetime size and as the subcontracting work on munitions orders spreads activities widely throughout the metal-working field.

Machine Tools—The machine tool industry is making extraordinary efforts to speed up production. Already output is twice that of a year ago. Operations now are on a basis closely approaching $500,000,000 a year, or five times the annual business normally handled. Expansion of plant capacity is much greater than supposed. Today factories are 50 per cent larger than in November, 1939, and construction of plant additions still is going forward. In one machine tool center alone, six companies have just completed or are in the process of erecting additions. In several cases machine tool builders have enlarged floor space materially two or three times since the war started. Most of the expansion has been privately financed, though government money is involved in a few instances. Steps have been taken in Washington to clarify preference ratings on defense orders most of which have been designated as A-1 work. Formation of the Machine Tool Priorities Advisory Committee insures that essential machine tool orders for non-defense industries will get priority ratings and that British deliveries will not suffer.

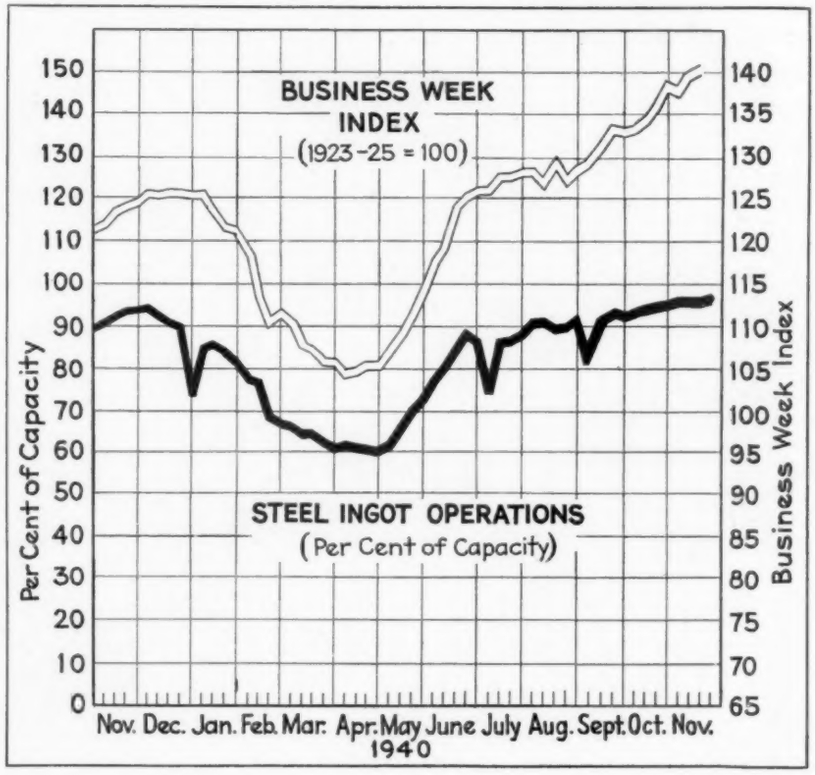
Munitions—The War Department continues to make big awards of contracts for ammunition components and for artillery and small arms ammunition. Orders for $20,299,459 for loading artillery ammunition have gone to three government-owned plants now being built at Wilmington, Ill., Ravenna, Ohio, and Burlington, Iowa. One of the largest defense orders placed in the middle west is for $7,614,630 of ammunition components to be supplied by Ingersoll Steel and Disc Division of Borg-Warner. Borg-Warner now has about $14,200,000 of defense business, of which $4,600,000 covers subcontracts. It also is negotiating for new contracts that may exceed $10,000,000. Kelsey-Hayes at Detroit, reported making 50-mm. machine guns for the British, is said to have been urged by the British to double its capacity.

Steel—The rush of steel buying has been further intensified. This is believed due to a desire on the part of consumers to build up larger stocks in anticipation of a possible imposition of priorities on defense orders. Mill operations continue close to the industry's theoretical capacity, and no change is looked for. Actual consumption is above 90 per cent, despite users' efforts to add to inventories.

Aircraft—Airplane engine production is being accelerated by all three major builders. Allison turned out 286 liquid-cooled engines in October, compared with 223 in September and 65 in August. The new buildings at Allison will be ready in January and all machinery for a big expansion program will be installed by next September. A year from now output is expected to be 1,000 engines a month. The new Lockland, Ohio, plant of Wright Aeronautical Corp., where Wright engines will be built, will be operated on a two-shift basis 10 hours to a shift, six days a week, according to present plans. The Navy has placed two airplane orders totaling $93,842,500 with Consolidated Aircraft. Work has begun on the new $11,243,000 Curtiss-Wright airplane factory at St. Louis.

Farm Equipment—Manufacture this year has about reached the volume of the peak years 1936 and 1937. Exports the first nines months of 1940 were $61,800,000, or not far from last year's total of $68,094,306. Thus far the industry has received only $12,000,000 of defense orders about half of which is for tractors.

Railway Equipment—The year's total bookings are estimated at 445 steam and diesel electric locomotives, 57,000 freight cars and possibly 300 passenger cars. If these figures are attained, 1940 will prove the biggest year since 1929 with the exception of 1936 when a rush of business in the final month shoved up the total to 536 locomotives and 67,544 freight cars. Outstanding inquiries amount to 6,000 to 7,000 freight cars.



DISTRIBUTION OF U.S. CONTRACTS

WASHINGTON—Of $7,616,650,000 which has been spent for defense up to November 1, more than $2,000,000,000 went to concerns in New York, New Jersey, and Pennsylvania. A geographical distribution of the contracts awarded, not including subcontracts, is as follows:

New England, $1,322,478,000; **Middle Atlantic,** $2,090,227,000; **North Central,** $1,013,699,000; **South Central,** $332,655,000; **South Atlantic,** $1,171,197,000; **Pacific Mountain,** $1,396,000,000; **Territories,** $1,463,157; and **Unassigned,** $210,141,000.

Create Machine Tool Priorities Board to Speed Defense Orders

WASHINGTON — A Machine Tool Priorities Advisory Committee has been created to insure against delay on essential orders for machine tools for non-defense industries and for the British. Mason Britton is chairman of the committee. Other members are Frederick V. Geier, president National Machine Tool Builders' Association; Clayton R. Burt, chairman Defense Committee of the association; Lt.-Col. A. B. Johnson representing the Army; and Com. Henning representing the Navy.

The new committee is subordinate to the Knudsen-Stettinius-Henderson Priorities Board. It can act only in an advisory capacity, but if its recommendations are accepted by the Priorities Board, they become law. The committee's relationship to the Army and Navy Munitions Board's Priorities Committee has not yet been decided.

Thus far non-defense commercial orders for machine tools and British orders have had no priorities ratings. Builders have been able to slip into their schedules a certain number of non-defense orders and at the same time meet the specified delivery dates on munitions orders, but that condition will not continue as business from munitions makers greatly increases. Priority rating should be given an order from an airline for machine tools for maintenance purposes. Determination of policies governing ratings and their relationship to munitions priority ratings will be decided by the new committee.

Though the British orders have had no preference ratings, word went out from Washington to machine tool builders that these orders were not to lose their positions on production schedules because of new defense business. The Machine Tool Priorities Advisory Committee now has the job of giving British orders an official status on the priority list.

U.S. Takes Steps to End Confusion Among Machine Tool Builders on Priority Ratings

WASHINGTON — Steps have been taken by the government to straighten out priority ratings on munitions contracts to end the confusion existing among machine tool builders regarding orders with A-1 ranking. The Army and Navy Munitions Board's Priorities Committee has sent to all machine tool companies a list of defense products most urgently needed arranged to indicate the order of their precedence.

While this list is a military secret and cannot be published, the fact is publicly known that gages and machine tools themselves head the list. They ran ahead of guns, shell, aircraft parts, tanks and other strictly ordnance items. About $16,000,000 of gages will be required the next two years for the defense program, and the capacity of the gage manufacturing industry now is only around $5,000,000 a year. The shortage will be remedied as rapidly as possible by new plant additions to be built, with government money, by four gage makers—Pratt & Whitney, Taft-Peirce, Greenfield Tap & Die, and Sheffield Gage.

Machines for gage makers, in fact, are likely to receive the AA rating, which is an emergency classification justifying a machine tool builder in taking machines right off the shipping room floor and delivering them, regardless of previous destination.

Recently practically all machine tool orders in connection with munitions work have had an A-1 rating. So many A-1 ratings were allotted, in fact, that many machine tool companies say that such a rating merely insured a buyer against being shoved farther down the waiting list. The AA emergency rating has been invoked in only a few rare instances for items whose identity has been kept secret.

The preferential list prepared by the Army and Navy Munitions Board's Priorities Committee is intended to help machine tool builders to decide which orders should be filled first when conflicts occur in delivery dates. It does not invalidate the general rule that the specified delivery date on an order means more than its priority rating. Thus, if a machine tool builder has an A-2 order for delivery Jan. 2 and an A-1 order for delivery Jan. 15, and if he has been able to arrange his production schedule in such fashion that he can meet both delivery dates, he is at liberty to do so.

Wide World

Canada's Mass Production—*Nearest thing to the mass production methods of the American auto industry yet introduced into plane production in Canada, is the method used in building two-seater dual-control light training planes. Above is a line-up of the planes on the assembly floor*

Canada's War Bill, Over 2 Million Per Day; Industrial Employment Increases Steadily

MONTREAL—For the month of October Canada's war expenditures exceeded $81,000,000, or approximately $2,666,000 per day. In June and July Canadian war expenditures were at a daily rate of $1,300,000, in August about $2,000,000. Next year war and peace time expenditures will be somewhere between 2 and 3 billions, or about $9,000,000 per day.

War costs are being financed from higher taxes, borrowing within the country. The Excess Profits Tax takes 75 per cent of the increase in profits over a base rate, average profits during 1936-39. Observers soon expect the opening of U. S. financial markets to aid Canada.

Appoint Labor Board

To meet one of its big problems, a limited skilled-labor supply, a Labor Board has been appointed charged with the responsibility of training men for war industries, diverting skilled men from non-essential to war industries. Firms enticing men from plants engaged in war work will be fined. During the past six months the government's employment index has recorded an increase of 3½ per cent each month. Employment has increased most rapidly in plants making iron and steel products, automobile equipment, ships, and electrical equipment. Another new board, Wartime Requirements Board, has been appointed to increase the effectiveness of the country's war effort. H. R. MacMillan, now government timber controller, will head the new agency. Responsibility of the new board will be to unify the operations of war industries; in effect it will be a central planning board.

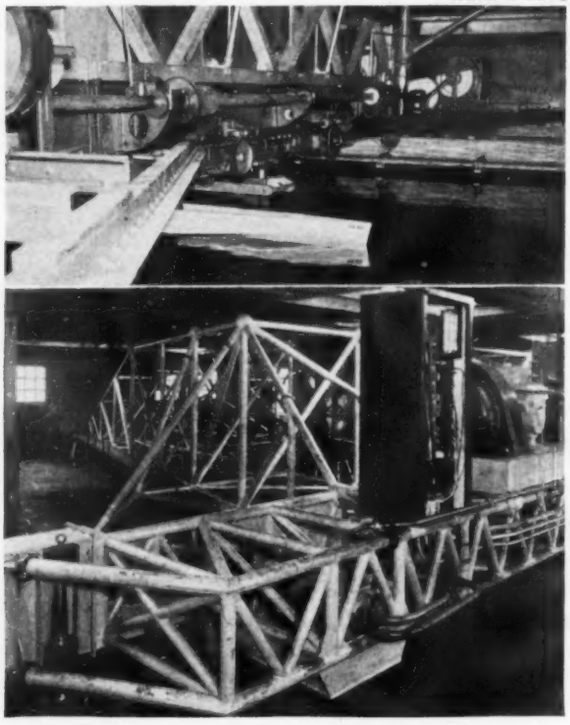
Canada's shipyards are preparing to build cargo ships for the British government. The following shipyards are equipped to build freighters: Canadian Vickers, Montreal; Dominion Steel & Coal Corp., Halifax; Canada Steamship Lines, Lauzon, Quebec; St. John Drydock.

Fleet Aircraft, Ltd., Fort Erie, Ont., has been awarded an order totaling $4,065,768 for the construction of advanced training planes. The craft is an all-metal, low-wing monoplane, has a maximum speed of 193 miles per hour, a cruising speed of 163. Production of these planes is already well advanced at the company's expanded plant.

Recent government awards are: Aircraft, Aviation Electric Ltd., Montreal, $64,598; Dominion Hoist & Shovel Co. Ltd., $13,900; Machinery, Canadian Fairbanks-Morse Co. Ltd., Ottawa, $14,136; Dominion Hoist & Shovel Co. Ltd., Montreal, $46,170; and International Harvester Co. of Canada Ltd., $12,538.

Munitions, Anaconda American Brass Ltd., New Toronto, Ont., $34,260; Shipbuilding, General Supply Co. of Canada Ltd., Ottawa, $55,212; and Halifax Shipyards Ltd., Halifax, $29,422.

Harris & Ewing



Old and New—*Are the towing carriages at the right. The machine pictured at the top has been pulling model boats through the water since 1900. Its replacement (below), if all predictions come true, is ready for the trip to the Carderock Basin, Md., the Navy's testing grounds. The apparatus allows a close study of the behavior of a ship before it is built.*

Concerns Seek U.S. Tin Smelter; Apply for Federal Finances

WASHINGTON — Eight different smelting concerns, some of them foreign and some domestic, have applied to the RFC's Metals Reserve Company for rights and federal financing to set up a tin smelter in this country. It is a reasonable guess that the Defense Commission and Laon Administrator Jones will choose a foreign concern, because an American concern would get little consideration from the world tin cartel, which is all-foreign, and probably would be squeezed out after the war.

Choice of concern may be announced before this report is printed. Tin ore will come from Bolivia, whose industry (outside of the Patino interests) has agreed to supply us with enough concentrate to produce 18,000 tons of fine tin per year for five years.

It is being predicted in Washington that the Defense Commission will soon ask manufacturers of munitions to use foreign copper which would be admitted free of the 4 cent excise tax.

New Towing Carriage, Designed By Navy, Tests Stability of Ships

LONG ISLAND CITY, L. I.—A new towing carriage, the function of which is to ascertain the overall characteristics of a boat prior to its being built, has just been completed by Machinery Builders, Inc., Long Island City. The apparatus, designed by Capt. H. E. Saunders, Technical Director of the David W. Taylor Model Basin, Md., will be moved this week to the new $5,000,000 Carderock Basin, Md., near Washington, D. C., where it will be operated.

The carriage, which is to the shipbuilder as the wind tunnel is to the airplane manufacturer, runs as a traveling crane in a steel mill, weighs 66,000 lbs., costs $200,000, travels at a speed of 15 to 20 miles per hour. As the machine pulls model ships through the water, it allows a close study of the ship's behavior. Hull lines and propeller design may be checked, the force required to propel a boat may be measured. The performance of a full-sized ship can be predicted in advance of its construction by study of the little prototype on its basin runs.

Navy men hope that the new model towing carriage will replace the one now in use. More rigidity, greater accuracy, and more varied findings are expected in the new machine. The apparatus has been designed on a principle similar to the carriage used in the high-speed seaplane basin located at Langley Field, Va.

C.I.O. and A.F.L. Conventions Indicate "Moderates" Are Taking Over Leadership

ATLANTIC CITY, N. J.—As the Congress of Industrial Organizations wound up its third Constitutional Convention in Atlantic City, and the American Federation of Labor marked its 60th Birthday by a conclave in New Orleans, all indications pointed to the fact that "moderates" were taking over the saddle of leadership.

One of the puzzles was, just how serious will the C.I.O. be in implementing its condemnation of Communists and subversive elements? Others: will the eclipse of John Lewis mean a less belligerent C.I.O? How far is the A.F.L. prepared to go in mopping up on its racketeers? Will the verbal castigations of each other by the two groups impede labor unity, or will it have served to let off steam and make peace more likely? On only one of these issues was there a hint of what to expect.

It was the consensus that John Lewis or no John Lewis, the fire-eating days of the C.I.O. are over. The Atlantic City crowd was all officialdom, active policy-making officers of the C.I.O.'s 42 unions. Except for the "Leftists" among them, they were unanimous in recognizing that the temper of the times called for a different kind of union operation than that which identified the C.I.O. in the past. If the C.I.O. is to expand further, its growth must be peaceful.

Both labor meetings showed clearly that the unions are preparing to give new and greater emphasis to lobbying activities. All elements acknowledged the increasing importance of government's role in the days which lie ahead. The old, orthodox philosophy of "voluntarism"—that labor should depend only on its own strength—seems to be outdated. Although there were a few advocates of it at both conventions, they were a distinct minority. A Rubber Workers Union official summarized the new philosophy when he said, "one law, vigorously enforced, is worth more to labor than a hundred organizers and a million dollars." In effect, it means that the unions will give more attention to Washington and less to the factory gates.

In a period such as this, labor unions tend to stabilize. The leadership entrenches itself in power and management finds union representatives more "reasonable". The danger of industrial disturbances come, not from the union leadership, which tends to be conservative, but from the rank and file of unionists who may interpret their leaders' conservatism as timidity.

Export of Machinery During September, 1940

	September 1940	August 1940	September 1939
Electrical Machinery and Apparatus	$9,244,111	$9,688,513	$8,062,687
Power and generating machinery except automotive and electrical	1,588,044	1,462,055	1,113,665
Construction and conveying machinery	2,075,348	2,821,332	1,767,562
Mining, well and pumping machinery	3,220,322	4,144,971	4,500,147
Power-driven metal-working machinery	22,452,289	21,420,050	9,539,355
Other metal-working machinery	750,880	938,687	410,246
Textile machinery	1,024,113	1,141,173	819,714

Metal-Working Machinery

Engine lathes	850,509	1,024,332	418,944
Turret lathes	1,826,706	1,326,523	746,052
Other lathes	1,204,697	1,457,000	279,041
Vertical boring mills and chucking machines	845,087	1,333,474	498,728
Thread cutting and automatic screw machines	2,450,812	1,377,950	459,927
Knee and column type milling machines	2,080,354	756,859	644,152
Other milling machines	2,601,123	2,107,320	1,169,595
Gear Cutting machines	629,683	836,626	222,090
Vertical drilling machines	408,458	369,218	111,165
Radial drilling machines	246,406	230,760	142,659
Other drilling machines	739,130	318,015	214,367
Planers and shapers	666,875	564,407	142,932
Surface grinding machines	553,676	713,839	190,523
External cylindrical grinding machines	348,385	579,583	192,638
Internal grinding machines	380,363	924,321	294,353
Tool grinding, cutter grinding and universal grinding machines	617,770	718,869	278,275
Other metal-grinding machines and parts	1,217,316	1,567,809	471,071
Sheet and plate metal-working machines and parts	828,297	764,546	384,713
Forging machinery and parts	948,975	979,220	74,971
Rolling mill machinery and parts	1,100,016	1,175,648	1,038,370
Molding machines	32,818	39,616	9,879
Other foundry equipment and parts	126,083	165,777	206,256
Other power-driven metal-working machines and parts	1,731,624	2,083,228	1,348,384
Pneumatic portable tools	110,244	117,693	106,746
Other portable and hand or foot-operated metal-working machines and parts	191,805	197,447	119,006
Chucks for machine tools	62,345	56,254	28,042
Milling cutters, machine-operated threading dies, and taps and similar machine-operated metal cutting tools	116,555	197,344	55,040
Other metal-working machine tools and parts	269,931	369,949	101,412

Vultee Aircraft Strike Sets an Administration Precedent

WASHINGTON—The Vultee Aircraft strike in Southern California has precipitated an administration precedent. From now on, patient negotiation will be the rule in all except the most serious labor cases. An extended strike in a major plant, of course, would not be tolerated. Neither would the administration stand for a series of strikes against the defense program.

You cannot get definite answer from experts in Washington on the legal status of unions striking against defense manufacturers—except one; that the chief executive, as Commander-in-chief of the Army and Navy under the Defense Act of 1916 and under recent acts, can issue an emergency order to break a strike. and no doubt about it. But they point out that the right to strike, like free speech, is guaranteed by law.

It was unfortunate that both AFL and CIO leaders were tied up at conventions during the strike. Sidney Hillman, whose duty as defense commissioner is to aid production, and as CIO executive to aid the strike, was on the hottest spot.

There was talk of legislation to put defense production under a law similar to the Railway Labor Act under which strikes are legal only after negotiation and cooling off period, but this would take time—may not be further considered.

Southern California aircraft plants are on a 50¢ beginning wage, as compared with 75¢ at Boeing in Seattle. There are regional, living standard reasons for this. It remains to be seen whether raising Vultee basic wage will bring a general Southern California demand for increase. Two plants down there are CIO, two are AFL and the rest are independent or unorganized. This set-up does not appear to lend itself at the moment to concerted action.

Exports of Industrial Machinery Decline 4 Per Cent In September

WASHINGTON—U. S. exports of industrial machinery during September amounted to $36,890,941, a decline of 4 per cent from the August total of $38,466,083. However the feature of the month was the continued rise in exports of power-driven metal-working machinery, which surpassed the previous month's record total and reached the new high of $22,452,289. Shipments of machine tools to England amounted to $15,070,249, compared with $12,480,621 in August, and $7,954,726 in July, while consignments to Japan declined to $587,632 from $1,875,503 in August, and comparable exports to the Soviet Union dropped to $894,999 from $1,795,826.

Factory Problems Caused by Defense Orders Discussed at American Management Meeting

CLEVELAND — Factory problems caused by present and prospective national defense orders superimposed upon rising domestic demand were discussed before the Production Division, American Management Association, which met at the Cleveland Hotel, Nov. 12-13. More than 600 executives attended. Problems most frequently mentioned were difficulties in changing from single to multiple-shift operation, finding skilled men, training unskilled operators, and keeping down scrap and repair losses.

Most of the firms represented are now working two and three shifts, or even four six-hour shifts. Allan C. Curtiss, assistant to the general manager, Scovill Mfg. Co., said: "In these days of high taxes with higher to come, real economy demands that floor space be kept to a minimum, equipment be utilized 24 hr. per day if possible, and replaced with new equipment to cut cost of production."

Mr. Curtiss said that apprentice training is operated regularly on a two shift basis with the hope that boys exposed to multiple shift operation will find night work less repugnant when working at the trade. These shifts rotate at six-week intervals. A third shift has been added for regular employees, but boys will probably not be rotated through the three shifts.

Multiple-Shift Operations

The foreman's importance in maintaining multiple-shift operations was stressed by Henry V. Oberg, industrial engineer, Armstrong Cork Co. He has found that the most satisfactory operation of a department results from complete responsibility for its operation being vested in one foreman, regardless of the number of shifts. The foreman-in-charge has under him shift foremen or hourly shift supervisors, depending upon the importance of the operation.

GEORGE H. PRUDDEN

George H. Prudden, works manager, Vega Airplane Co., subsidiary of Lockheed, explained how scientific selection methods have been employed to weed out undesirable applicants for skilled and semi-skilled jobs in a rapidly expanding enterprise. Vega has 5000 men in training who have been selected by means of various tests, i.e. intelligence tests and mechanical aptitude tests. Written and manual tests are useful in showing up the "trade bluffer." Approximately 20,000 case histories have demonstrated that these tests have given surprisingly good results in keeping misfits out of the organization and providing the material that can make good.

New and inexperienced help was perhaps the major cause of scrap and repair losses during Products expansion from 1591 to 3960 workers, reports W. H. West, assistant factory manager. Experienced help was converted to supervision and the ratio of inexperienced help rose rapidly. Scrap and repairs on some items equalled pieces shipped.

Warner & Swasey has expanded its learner training program, begun in 1935, to include a large number of observers, who are assigned to instructor-operators. Ray J. Blyth, personnel director for Warner & Swasey, said observers were needed in anticipation of delivery of new equipment for the expansion program underway, that observers must meet the same requirements as other trainees. The object of the three to four month training period is to provide semi-skilled specialists able to handle a considerable amount of setting up or carry on a job remaining in the machine at the start of the shift.

BRITTON HEADS TOOL DIVISION

WASHINGTON—Mason Britton has been appointed Director of the Machine Tool and Heavy Ordnance Division of the National Defense Advisory Commission. He succeeds Harold Vance, chairman of the Board, Studebaker Corp., who has returned to active duty at Studebaker. Mr. Britton, who is vice-chairman of the McGraw-Hill Publishing Co., has been assistant to Mr. Vance since the Defense Commission was established. Mr. Britton will be assisted by Howard W. Dunbar, vice president, Norton Co.

CARLTON DIRECTS AUTO COMMITTEE

DETROIT—C. C. Carlton, vice president of Motor Wheel Corp., has been made permanent director of the Auto Committee for Air Defense. Mr. Carlton, who had been serving as acting director, has been granted a leave of absence from Motor Wheel, but he will continue to serve as president of the Automotive Parts & Equipment Manufacturers Inc. W. J. Cronin, Automobile Manufacturers Assoc., has been named assistant director.

Japanese Machine Tool Imports Decline; Retard Metal Exports

TOKYO—Japanese imports of machine tools for the first seven months of 1940 were estimated at $22,000,000. This marks a 25.8 per cent decrease for the corresponding period in 1939 when machine tool imports were $31,000,000. Imports of unspecified machinery parts were also off during this period from $11,000,000 to $7,500,000.

In order to check the outflow of steel and alloy metals, a new Department of Commerce & Industry order has prohibited articles made of iron or steel to be exported to markets other than Manchuria and China. Shipments to the latter are also subject to license. Japanese exports of machinery of every description during the first seven months of 1940 reached a value of approximately $73,300,000.

To replenish fast-waning stocks of iron and steel scrap, of which Japan imported 2,000,000 tons every year from the U. S., the Department of Commerce & Industry in Tokyo has decided to undertake a thorough investigation of machine tool and power plant installations, with a view to ordering inefficient, obsolete and idle plants turned into scrap. The steel obtained is to be used in the manufacture of new and more efficient machines. Some observers indicate that machine tools not yet put to use will be ordered scrapped if they do not meet the government specifications.

Electric Trucks and Tractors' October Bookings Set Record

CHICAGO—October bookings of electric industrial trucks and tractors were higher than any other previous month in the year. Figures compiled by the Industrial Truck Statistical Assoc., Chicago, indicate that 193 units were booked in October while 154 units were booked in September, the previous high month. Total net value at factories for chassis only was $653,682 compared with the previous high in July of $591,784.

INSIDE DETROIT

Rumor spreads that U. S. will build a plane assembly plant in Mid-west, that auto companies will help in mass production of airplane engines. Plans, however, are just in the "idea" stage

BY RUPERT LE GRAND, DETROIT EDITOR

DETROIT—Dame Rumor has allowed herself to get far ahead of the facts in regard to the auto, parts and tool industries' program to make plane parts for America and Britain. News despatches assert incorrectly that a $21,000,000 final-assembly plant for planes will be erected by the government in the Midwest, that the three major auto companies will produce the aviation motors required, and that structural components will be supplied by the three major body manufacturers.

Actually the whole program of producing planes by mass-production methods with the help of 1,000 local companies is hardly beyond the idea stage. Local executives early foresaw that two final assembly plants might properly be erected in the Midwest for assembling the Martin B-24 two-engined bomber and the Consolidated B-26 four-engined heavy bomber, respectively. These are new models "assigned" to the local effort. Chief reasons for this proposal, and that is all it amounts to at present, are the difficulties of getting together with distant plane plants on matters of manufacturing methods, limits, inspection of the hundreds of items in a bomber. In addition there is the difficulty of the shipping problem in connection with the larger structural elements.

Proposal Is Dynamite

There was dynamite in this proposal. Washington realized that. Some of the aviation crowd are reported very sore over seeing the auto industry getting set to produce plane parts in mass-production. They won't want the entire job handled in the Midwest, even if aviation men can be found to manage the final-assembly plants. So a "definite" statement that a $21,000,000 plant is to be erected near Detroit for final assembly purposes is viewed locally as "terribly premature." For one thing, the idea has not progressed to a definite plan; for another, why raise a political tempest over plant sites at this stage?

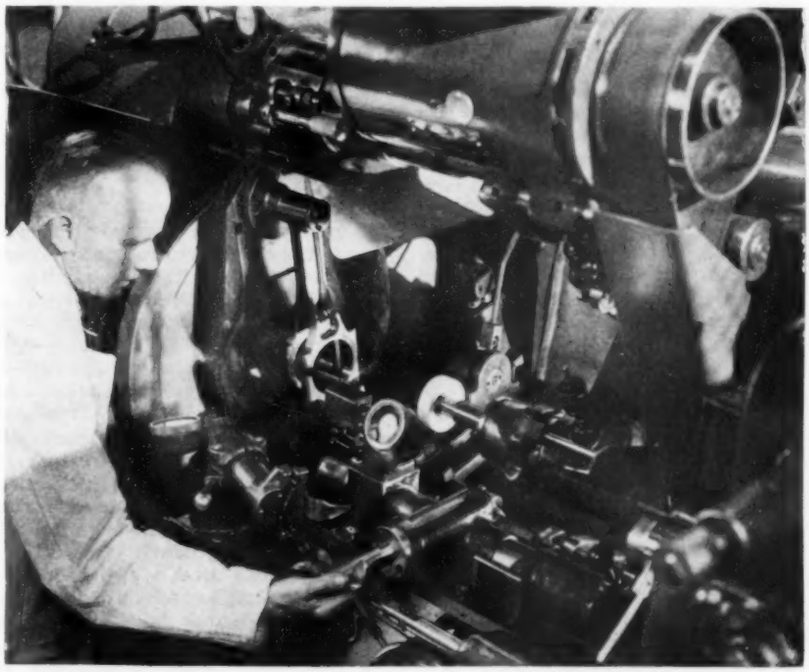
The line-up of auto companies which will produce aviation motors is nearly complete. Negotiations with Buick have been going on for production of Pratt & Whitney engines to about the same dollar value as ordered from Ford, according to reliable sources. Studebaker has been mentioned also. However, to place Chrysler in the picture along with General Motors and Ford is considered an error. It has been rumored that Chrysler has a 2000-hp. motor under development, and that they are very proud of the possibilities. But it is easy to forget that new aviation motors often require years of development and tooling work. Besides Chrysler has its hands full with one of the major jobs in the Army's list—tanks. Chrysler has leased 600,000 sq.ft. of floor space in the closed Graham-Paige plant, it is true, but the room is likely to be used eventually for other purposes than aviation motors. If a new motor is to be put into production, the play may go to the inverted twelve-cylinder design that Continental may have ready for final tests this fall.

Allison Division of General Motors has delivered 647 liquid-cooled engines since the first of July, after moving up to a production rate of 286 motors in October. Production will continue to gain slowly, attaining maximum capacity of 1000 motors per month about this time next year. Construction for the third expansion program will be completed in January, but all machinery will not be installed before September.

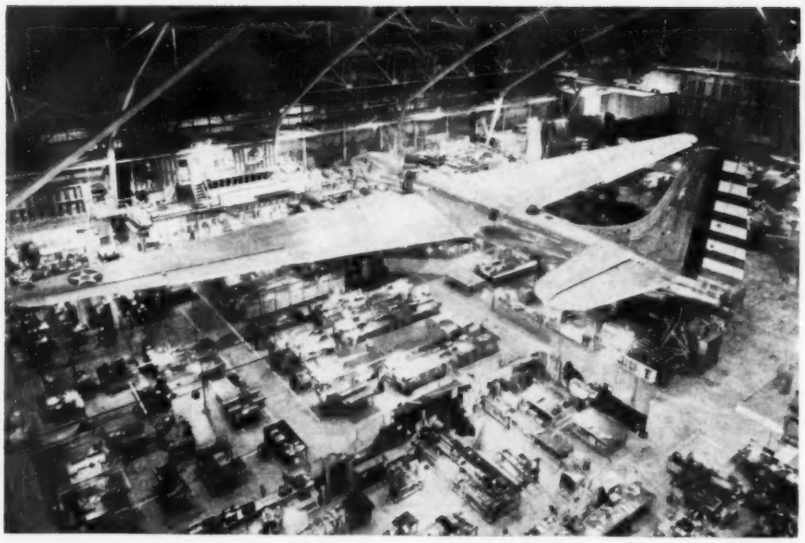
The first Allison expansion started in June, 1939, following receipt of an order for 969 engines from the War Department. More orders from the U. S. Government, the French

75 TANKS PER WEEK

DETROIT—Chrysler will build components for five tanks in one eight-hour shift per day, and will obtain certain assemblies from outside sources, usually two vendors per item, to boost the weekly assembly total to 75 units. Chrysler has purposely played down its achievements in tank development. Adaptation of auto assembly methods has in a measure simplified tank construction and at the same time made the "land battleship" much more effective. Latest information runs to the effect that Carnegie-Illinois will completely fabricate and machine the armor-plate structure at its Mingo Junction, Pa., plant. Cast-steel turrets will likewise be completely machined by two vendors —American Steel Castings and General Steel Castings.



Marine Power—*Packard Motor Co. has produced hundreds of the 1,350 h.p. V-twelve marine engines which power American-built "mosquito boats". Orders from Canada, Britain, the U. S. total $17,000,000. Above operator backs up sizing indicator before removing part from fixture*



Guardian Of a Hemisphere—*In Santa Monica, Calif. the Douglas B-19, styled as the World's Largest Airplane, is being completed. The giant bomber has a cruising range of 7,500 miles, carries 28 tons, measures 212 ft. from tip to tip. It is powered by four 2,000 h.p. Wright engines*

and British made the second and third expansions necessary. The British order was received May 25 this year. A year ago, Allison employed 900 workers. Now there are 7,200 at Indianapolis and 1,750 in the parts division at Cadillac. When the production peak is attained, 10,000 men will be employed at Indianapolis and 3,000 at Cadillac.

Among the body manufacturers, Murray has already eliminated itself from the bomber project because its available facilities will be tied up upon producing inner wing sections for Douglas. The outer-wing sections for Douglas overflow work will be handled by Briggs.

Organizational activities of the Auto Committee for Air Defense, the body set up to represent the auto, parts and tool industries in surveying facilities to make parts for the projected bomber program, have moved rather slowly. For one thing, it has been difficult to find a permanent director able to conduct the affairs of the committee as though it were the "little finger" of the Defense Commission's hand.

The Committee intends to incorporate itself as a non-profit organization. Administration costs will be recovered by charging a small fee to vendors who receive contracts.

Plans of the newly formed Aircraft Division, Murray Corporation of America, to make inner-wing assemblies for the Douglas A-20B two-engined bamber (a new type) will prevent the Detroit body manufacturer from participating in the program of the Auto Committee for Air Defense. All idle capacity has been reserved for the pending Douglas contract. Some 600,000 sq. ft. of floor-space have been made available for this work in the main plant.

While the Douglas contract has not been signed, both companies are working closely together upon a long-range mass-production plan. Published reports that Murray will make 1700 pairs of inner wing assemblies probably understate the amount of business to be handled. By the spring of 1942, Murray is expected to be in production of 75 pair of inner wings per week, and to be employing between 7500 and 10,000 people on the project. While it is impossible at this point to foretell the number of inner wings to be made and the number of years over which the contract will be in force, it is obvious that a manufacturing alliance of this size would not be undertaken for the published figures.

Murray is faced with the problem of putting one of the most complicated bomber structures upon a mass-production basis. The inner wing is literally a honeycomb of partioning elements and includes gas tanks, an engine nacelle, piping, hydraulic controls and a maze of other equipment. The structure must be riveted because present specifications do not permit welding. In plane plants an operator may perform several operations in connection with a riveting or assembly job because manufacture has been upon a small-lot basis. To attain mass production, however, Murray must break down each job into its simplest components and train an operator for each minute task. It is expected that production of inner wings will get underway in the spring of 1941, but the size of the training program faced by Murray will prevent the Aircraft Division from attaining the maximum production rate before spring in 1942.

EXPAND BRITISH PURCHASING COMMISSION

NEW YORK—The British Purchasing Commission has taken larger quarters here due to the increased activity of British purchasing of U. S. war material. The Commission which now employs 3,000 persons to handle its daily routine matters, has been able to increase its war orders in the U. S. due to recent action by the U. S. Priorities Board.

FBI Issues Booklet on "How To Protect Against Saboteurs"

WASHINGTON — A comprehensive booklet, "Suggestions for Protection of Industrial Facilities", has been prepared by the Federal Bureau of Investigation. This booklet is the result of a national survey by the FBI of the protective facilities employed by establishments having large government defense contracts. As an aid to industrial concerns in establishing effective protection against sabotage and espionage the FBI will provide organizations with such a booklet if requested by an executive official.

Physical Machine Tool Expansion To Date Disturbs Defense Planners

WASHINGTON—Defense Commission planners are disturbed about the absence so far of substantial physical expansion of machine tool capacity. Big increases in output are admitted, but these have largely been the result of three-shift operation and sub-contracting, expedients with definite limitations. The commission thus inherits a dispute which first arose when Secretary Morgenthau encountered resistance to his demands for what the industry considered undue expansion of physical capacity.

Although the commission is not unanimous on the point, a considerable group within it feels that production of civilian commodities must not be reduced, for fear of inflation if for no other reason. A machine tool output barely sufficient for defense would be fatal to this approach, which brings the problem sharply to the fore. Already there have been veiled accusations of unpatriotism and hints of a crackdown.

The commission is not unsympathetic to the industry's attitude. But the existence of the bankable contract plan, by which the government takes the financial risk and under which excess capacity at the end of the emergency can be turned back to the government, is felt to answer any reasonable objections.

WATCHING WASHINGTON

Millis' appointment to NLRB seen as bid for unity on defense problems. Federal Reserve aids small manufacturers to get in defense picture. Supreme Court strictly construes Wagner Act

By BLAINE STUBBLEFIELD

WASHINGTON — Appointment of Dr. H. A. Millis to the chairmanship of the NLRB, succeeding Warren Madden, whose term expired last August, has several important implications. It was the President's first major executive act since his re-election, and Washington takes it as a favorable gesture toward business for speed in defense production. Dr. Millis is regarded as an independent thinker on industrial relations, and it is expected he will see pretty much eye to eye with William M. Leiserson, thus putting Edwin S. Smith in a minority position and ending the present deadlock.

The appointment is a bid for unity on defense problems also in that it appeases the largest possible group of opponents to the Labor Board—namely, the American Federation of Labor plus the business bloc which stands almost united against it. The appointment is Roosevelt's answer to John Lewis' opposition and it is a great blow to Lewis and to the CIO.

Still further, a Millis-Leiserson dominated NLRB probably would put down any demand for a special labor board to adjudicate labor disputes involving production for the Army and the Navy.

There was no doubt, as this was written, that the Senate would confirm Madden without a murmur for a job among the ancient case records of the Court of Claims where the President proposes to pension him off as one of the five Claims judges.

Orders For Small Manufacturers

Arrangements have been made for the small manufacturer to determine whether and how he can get into defense production. Donald Nelson, Defense Commission coordinator of purchases, explains that the manufacturer, who has no representative in Washington and is not familiar with federal contracting, should go to a Federal Reserve Bank or a branch, an officer of which can tell the manufacturer (1) whether the Government wants to buy what he produces; (2) if not, then whether his plant is able to make something else the Government does want; (3) where to apply for credit if he needs it; (4) how to negotiate his contract if he is in line for one. The bank officer will also inform the Government of the manufacturer's business standing and his personal reputation. In a general way, the defense plan is for the big companies to run the assembly lines while the small firms of the nation feed them the parts, though of course some big firms still make a large part of their own.

Overtime Pay Still Required

The obligation of employers to pay time-and-a-half for time over 40 hours per week is not voided by the existence of a union contract calling for a workweek of more than 40 hours without payment of overtime, except in certain instances, Wage-Hour Administrator Philip Fleming has warned. Labor contract clauses providing for more than 40 hours without time-and-a-half will have no legal standing, he said. While the Administration is pledged to maintain the hours standards, it would not be safe to predict that it will succeed. It has already been pointed out by industry leaders that the hours standards were set up to spread employment for the unemployed. If and when nearly all employables are at work, the only effect of the law would be to force employers to pay high wages.

Wagner Act—No Penal Program

Some time ago the Labor Relations Board issued an order that Republic Steel must reimburse the Government for relief paid to workers between the time Republic discharged them and the time it reinstated them under order. Republic appealed to the Supreme Court. All but two of the Justices (Black and Douglas) signed a majority opinion for the appellant. In effect they said that the Wagner Act is a remedial measure that it "does not carry a penal program declaring the described unfair labor practices to be crimes." They further said that "if such a deterrent effect is sufficient to sustain an order of the Board, it would be free to set up any system of penalties which it would deem adequate to that end." Reducing this decision to fundamentals, it means that the letter of the law, and not what the Board may choose to make it mean, shall be applied. Then if the law is not satisfactory, it is the responsibility of Congress to change it. And incidentally, the appointment of Dr. Millis to the Board is not regarded here as likely to afford sufficient administrative remedy as business sees the Act. The House of Representatives still wants its amendments, and they will be brought up before the next Congress.

MACHINE TOOLS AVAILABLE

WASHINGTON — More than 2,000 machine tools stored at army arsenals, principally at Rock Island, have become available for lease to private manufacturers with munitions contracts. These machines, in many cases, were delivered new to the arsenals toward the end of World War I and never have been used. Terms on which they may be leased are understood to be 12 per cent a year based on today's appraised value of the machines. In one case arrangements were completed with a machine tool builder to get machines on this basis without waiting for a formal contract.

"Not by A Bombsight!"

Having refrained from loose gossip about "the bombsight", we've earned the right to jot down a few facts. There are several sights; not just one. The Army has one or more and the Navy has one or more. The Army's most accurate sight is the one manufactured by the Sperry Gryoscope Company, and it is the one that has just been turned over to the British. It was turned over because the President, supported by a preponderance of public and military opinion, believes the front line of the United States is on the English Channel. Whether or not this sight will drop a bomb down a rain barrel, as often reported, we don't pretend to know. It stands to reason that, with the fate of nations hanging on aerial warfare, best technicians of each are keeping up on the art. It is believed that Sperry will actually build and deliver most of the sights for the British, but some may be built by other firms, possibly some by the British themselves. If, a few weeks from now, you read of miraculous exploits by the RAF, you can assume the sight is as good as the stories about it. A plausible report is that a small shell is being placed in sights delivered to RAF which can be exploded at the will of the pilot.

Nationalized Plane Production, U. S. Ownership of Plant Seen

WASHINGTON — Nationalization of aircraft production, currently worrying some heavy thinkers, is largely a matter of terminology. In a sense it is already here; plane builders build what, where, and how they're told to from Washington. In the sense of government ownership of plant it is inevitable in the next few years. The new assembly plants to be built in the midwest in connection with auto-plant parts manufacture apparently will be government-owned—like the powder mills and tank factories. But the expansions being carried out by the private aircraft manufacturers are largely being financed by the so-called "bankable contract." Under this plan, the plants become the property of the government in five years unless the private operator decides to buy them back. If the emergency is then over and the airplane industry has shrunk to pre-war size few plants will be bought. Thus, by far the largest part of the industry will be government owned.

There is no evidence at present, however, of any interest in government operation of manufacturing plants. Indeed the long-existant Naval Plane Factory is not being notably expanded. Private firms run the plants, either as owners subject to an ever-increasing mortgage under bankable contracts or perhaps, in the new assembly plants, as agents of the government. How a post-war administration would feel about this remains to be seen.

18 Per Cent Increase in Gear Sales Is Recorded for October

WILKINSBURG, PA. — The American Gear Manufacturers Association, representing the Gear Industry of the U. S., reports that gear sales for October were 18 per cent above September of this year and 53 per cent above October of 1939. The ten months ending with October 1940 are 47 per cent above the corresponding period in 1939.

Comparative Index Figures

	1940	1939
October	216	141
September	183	126
August	191	96
July	141	89
June	129	90
May	133	93
April	128	88
March	114	104
February	116	86
January	123	91

The monthly average for the first ten months in 1940 was 147; for the same period in 1939, 100.4.

U. S. Government Contracts Awarded to Metal-Working Firms

(Does not include contracts under $100,000)

Source	Agency	Commodity	Amount
Western Cartridge Co., East Alton, Ill.	War	Cartridges	$1,112,500
Bethlehem Steel Co., Bethlehem, Pa.	Navy	Forgings	506,250
Carnegie-Illinois Steel Corp., Munhall, Pa.	Navy	Steel forgings	777,012
Universal-Cyclops Steel Corp., Bridgeville, Pa.	War	Steel rods	145,115
Carpenter Steel Co., Reading, Pa.	War	"	145,863
Bethlehem Steel Co., Bethlehem, Pa.	War	"	146,362
Allegheny Ludlum Steel Corp., Watervliet, N. Y.	War	"	144,866
Fort Pitt Bedding Co., Pittsburgh, Pa.	War	Metallic belt links	419,200
Struthers Wells-Titusville Corp., Titusville, Pa.	War	Forgings	127,000
Crosby Co., Buffalo, N. Y.	War	Cartridge cases	1,175,600
American Tool Works Co., Cincinnati, Ohio	Navy	Lathes	181,116
Clark Equipment Co., Battle Creek, Mich.	War	Tractors	743,457
Harvey Metal Corp., Chicago, Ill.	War	Machining forgings	245,030
Warner & Swasey Co., Cleveland, Ohio	War	Lathes	331,268
R. K. LeBlond Machine Co., Cincinnati, Ohio	Navy	Lathes	105,759
Guiberson Diesel Engine Co., Dallas, Texas	War	Diesel engines	2,915,095
International Harvester Co., Chicago, Ill.	War	Tractors	2,272,500
Consolidated Machine Tool Corp., Rochester, N. Y.	Navy	Lathes	487,165
Lodge & Shipley Machine Tool Co., Cincinnati, Ohio	Navy	Lathes	145,808
Grumman Aircraft Engineering Corp., Bethpage, L. I., N. Y.	Coast Guard	Airplanes	221,634
Aero Equipment Corp., Bryan, Ohio	War	Propeller hub assy	100,672
Bell Aircraft Corp., Buffalo, N. Y.	War	Airplanes	4,962,220
Superior Trailer Mfg. Corp., Indianapolis, Ind.	War	Trailers	539,002
Autocar Co., Ardmore, Pa.	War	Tractor-trucks	350,880
General Motors Corp., Chevrolet Div., Detroit, Mich.	War	Trucks	899,698
Mack-International Motor Truck Corp., Washington, D. C.	War	"	210,951
Jack-Heintz, Ltd., Palo Alto, Calif.	War	Starter assys	2,535,367
Gar Wood Industries, Inc., Detroit, Mich.	War	Carriages	1,918,983
J. G. Brill Co., Philadelphia, Pa.	War	"	148,060
Timken-Detroit Axle Co., Detroit, Mich.	War	High speed adapters	624,030
Saginaw Stamping & Tool Co., Saginaw, Mich.	War	Bomb trailers	234,562
Diamond T Motor Car Co., Chicago, Ill.	War	Service trucks	104,584
White Motor Co., Cleveland, Ohio	War	Scout cars	5,412,956
Bendix Aviation Corp. (Pioneer Instrument Div.), Bendix, N. J.	Navy	Indicators	651,947
Bendix Aviation Corp. (Eclipse Aviation Div.), Bendix, N. J.	War	Data transmission system	1,970,119
Struthers Wells-Titusville Corp., Titusville, Pa.	Navy	Forgings	184,295
Camden Forge Co., Camden, N. J.	Navy	"	116,893
Midvale Co., Philadelphia, Pa.	Navy	"	616,153
National Tube Co., Pittsburgh, Pa.	War	Body forgings	264,147
Lansdowne Steel & Iron Co., Morton, Pa.	War	"	176,640
Pennsylvania Forge Corp., Philadelphia, Pa.	Navy	Forgings	267,641
Erie Forge Co., Erie, Pa.	Navy	"	1,162,366
National Forge & Ordnance Co., Washington, D. C.	Navy	"	1,006,003
Crucible Steel Co. of America, New York, N. Y.	Navy	"	2,332,343
Harrisburg Steel Corp., Harrisburg, Pa.	War	Demolition bombs	265,000
Federal Screw Works, Chelsea, Mich.	War	Booster parts	560,774
Bridgeport Brass Co., Bridgeport, Conn.	War	Cartridge cases	364,965
Scovill Mfg. Co., Waterbury, Conn.	War	" "	244,200
" " " "	War	Fuse parts	288,000
" " " "	War	Booster parts	102,410
Stewart-Warner Corp., Chicago, Ill.	War	Fuses	1,371,360
Bullard Co., Bridgeport, Conn.	War	Boring mills	299,815
American Engineering Co., Philadelphia, Pa.	Navy	Windlass	517,200
Heil Co., Milwaukee, Wis.	War	Semi trailers	2,114,594
Standard Steel Works, North Kansas City, Mo.	War	"	1,182,005
Mercury Aircraft, Inc., Hammondsport, N. Y.	War	Trainer assys	125,737
Packard Motor Car Co., Detroit, Mich.	War	Aircraft engines	62,448,000
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.	War	Gun carriage	102,025
Breeze Corp., Inc., Newark, N. J.	War	Starters	195,030
Bendix Aviation Corp., Eclipse Aviation Div., Bendix, N. J.	War	"	271 308
McCauley Steel Propeller Co., Dayton, Ohio	War	Blade assys	308,880
Bendix Aviation Corp., Eclipse Aviation Div., Bendix, N. J.	War	Energizer assys	302,570
Glenn L. Martin Co., Baltimore, Md.	War	Gun turrets	738,555
Autocar Sales & Service Co., Ardmore, Pa.	War	Tractor-trucks	1,565,646
Ingersoll-Rand Co., Phillipsburg, N. J.	War	Machinery	449,434
Auto Ordnance Corp., Bridgeport, Conn.	War	Small arms material	3,108,854
Yellow Truck & Coach Mfg. Co., Pontiac, Mich.	War	Trucks and parts	3,381,915
U. S. Steel Export Co., New York, N. Y.	War	Ammunition components	150,832
Saginaw Stamping & Tool Co., Saginaw, Mich.	War	Trailers and accessories	289,599
Ford Motor Co., Alexandria, Va.	War	Trucks	171,430
Universal Crusher Co., Cedar Rapids, Iowa	War	Small arms material	244,125
J. Cunningham Sons & Co., Rochester, N. Y.	War	" " "	294,600
Square D Company, Kollman Instrument Div., Elmhurst, N. Y.	War	Indicator assemblies	222,000
Niles-Bement-Pond Co., Pratt & Whitney Div., West Hartford, Conn.	War	Drill Presses	120,255
C. M. Gosiger Mach'y Co., Dayton, Ohio	War	" "	141,500
Banner Die Tool & Stamping Co., Columbus, Ohio	War	Shackle assemblies	141,750
Spriesch Tool & Mfg. Co., Inc., Buffalo, N. Y.	War	" "	335,920
Bendix Aviation Corp., Bendix Products Div., South Bend, Ind.	War	Wheel-brake assemblies	235,526
Wright Aeronautical Corp., Paterson, N. J.	War	Maintenance parts for Wright engines	218,851
Bridgeport Brass Co., Bridgeport, Conn.	War	Artillery components	135,000
Square D Company, Kollman Instrument Div., Elmhurst, N. Y.	War	Altimeter assemblies	2,745,985
Weston Electrical Instrument Corp., Newark, N. J.	War	Indicator assemblies	1,509,420
International Harvester Co., Chicago, Ill.	War	Tractors	631,172
Crown Cork & Seal Co., Baltimore, Md.	War	Small arms material	1,147,030
American Car & Foundry Co., Milton, Pa.	War	Tank cars	679,640

NAMES in the NEWS

W. C. Buchanan, former president of Globe Steel Tube Co., Milwaukee, has been elected a member of the Board of Directors of Allis-Chalmers Mfg. Co.

George F. Chapline, vice-president in charge of sales of the Wright Aeronautical Corp., resigned that post to become president and general manager of the Brewster Aeronautical Corp. He has been identified with the Wright organization in various capacities since 1929.

Other changes in Brewster Aeronautical's executive set-up designed primarily to expand the company's executive forces to speed up production on more than $100,000,000 of defense orders for the United States Navy and foreign aircraft, included the election of James Work as chairman of the Board of Directors, in which capacity he will remain active in the affairs of the company; of Dayton T. Brown as vice-president in charge of research and development, and of William L. Smith as vice-president in charge of material.

William D. Kennedy, service manager of Wright Aeronautical for 12 years, will succeed Mr. Chapline as sales manager; Philip B. Taylor was made assistant general manager, and P. W. Brown was appointed assistant works manager.

John Dykstra, formerly general superintendent of production, has been named assistant works manager of the Olds Motor Works. Roy A. Fishel, superintendent of the Six and Eight Motor Plants, has been named night superintendent.

A. W. Gardes has been appointed factory manager of the Eureka Vacuum Cleaner Co., Detroit.

C. E. Harrison, vice-president of the American Engineering Co., Philadelphia, has been named general manager. He will have general supervision of the entire activities of the company in addition to his duties as vice-president.

E. J. Hunt, formerly general staff master mechanic of Chrysler Corporation, has been appointed operating manager in charge of the Chrysler Tank Arsenal. The $20,000,000 arsenal which is being built on contract from the United States War Dept. will begin to turn out medium (25 ton) tanks at the rate of five per day per shift in about a year. Mr. Hunt has been placed in charge of building, equipping and directing this operation.

L. R. Ludwig has been appointed manager of two newly combined sections of the Switchgear Div. of Westinghouse Electric & Mfg. Co. Mr. Ludwig, who has been manager of protective devices engineering for the last five years, will head the combined division of circuit breaker and protective devices engineering.

Leaves Caterpillar

W. ROGERS

Engineering Co. Mgr.

C. E. HARRISON

Heads Tank Arsenal

E. J. HUNT

David S. Lewis has been appointed assistant to the sales manager of Jessop Steel Co., Washington, Pa.

E. R. Perry has been appointed executive assistant to the president of the Boeing Aircraft Co. Mr. Perry has served in a managerial and executive capacity with several leading manufacturing and sales organizations of the country, including the Eastman Kodak Company of Rochester, N. Y., and the Flintkote Co., New York. In the newly-created position, which he will occupy in the expanding Boeing Aircraft Co., Mr. Parry will assist in the executive and administrative work of the president's office.

W. Rogers, general factory manager of Caterpillar Tractor Co., Peoria, Ill., will retire on December 1. The position of general factory manager in the company will be discontinued.

W. T. Roundy has been transferred to the Atlanta office of Cutler-Hammer Inc., Milwaukee.

Ralph H. Rowland, sales manager, and Charles E. Dewar, superintendent, have been named vice-presidents of the Champion Spark Plug Co., Toledo. Mr. Dewar has been given charge of production in all company plants including the British and Canadian units. Charles L. Corwin succeeds Mr. Rowland as sales manager.

William F. Wise, president, Republic Aircraft Corp., has been elected executive vice president of Aviation Manufacturing Corp. He will continue to head the activities of Republic in addition to his new duties. At one time Mr. Wise was vice president in charge of sales of Ex-Cell-O Corp.

Jack F. Wolfram, experimental engineer, has been named assistant chief engineer in charge of engine, transmission and the axle design

V-P at Aviation Corp.

WILLIAM F. WISE

Wright's Ass't Mgr.

P. W. BROWN

Oldsmobile Promotes

M. A. THORNE

and development division of Oldsmobile. Maurice A. Thorne, chassis engineer, has been named assistant chief engineer in charge of body, chassis, electrical, accessory groups and office administration. John Oswald, body engineer, will serve as Oldsmobile's director of styling.

Gordon R. Walker, has been named vice-president and sales manager of the Walker Mfg. Co., Racine, Wis., succeeding Malcolm McCormick, who has resigned.

Oliver Smalley, vice-president, and H. B. Hanley, secretary-treasurer, both of the Meehanite Research Institute of America, Inc., have been reelected.

PLANT EXPANSION

Kearney & Trecker Corp., West Allis, Wis., is erecting two new additions to its plant at a cost of $10,000.

Ex-Cell-O Corp., Detroit, will embark on a $3,000,000 expansion program for stepping up manufacturing facilities on precision aircraft parts by 50 per cent. Work has already been started in the new plant, and it is expected that it will be up to full capacity by April.

Air Associates, Inc. will start construction within a few weeks of a $200,000 one-story plant at the Los Angeles Municipal Airport. The floor area will cover 50,000 sq.ft. and will double the present capacity of West Coast operations of the company. The company is the largest manufacturer and distributor of Aviation parts and equipment in the world.

Wakefield Brass Co., manufacturer of commercial lighting equipment, will begin an expansion program to double the size of its plant in Vermilion, Ohio.

Houde Engineering Corp., Buffalo, will construct a $500,000 plant to manufacture precision instruments for the national defense program.

High Standard Mfg. Co., New Haven, Conn., will erect a new factory at Hamden, Conn. Expansion has been prompted by a $12,000,000 for 12,400 .50 caliber machine guns placed with the company by the British Purchasing Commission.

Tennessee Coal, Iron and Railroad Co., Birmingham, Ala., United States Steel subsidiary, has embarked on an expansion of the steel making and finishing facilities. An approximate 20 per cent increase in the ingot capacity, the finishing capacity, will be provided by the new facilities.

Photo by Christian Science Monitor

Heads Council—*Ralph E. Flanders, President, Jones & Lamson, Springfield, Vt., has recently been made head of the New England Council. Mr. Flanders is a past-president of the A.S.M.E. Above he is seen examining a new artillery range finder*

Diamond T Motor Car Co. has started work on a second large addition to its Chicago plant. The unit will be 600x120 ft. and will cost $175,000. The additional space is required to take care of two government orders totalling 2,998 trucks which cost about $19,220,000.

Pratt & Whitney Div. of Niles-Bement-Pond Co., manufacturers of precision instruments, will add a $750,000 addition to its West Hartford, Conn. plant. Employment will be provided for an additional 600 to 700 men.

BUSINESS ITEMS

Lidgerwood Mfg. Co., Elizabeth, N. J., has acquired the Superior Iron Works, Superior, Wis.

The National Fireworks Co., Whitman, Mass., has taken over the plant formerly occupied by the Atwood Box Co., and will manufacture cartridges up to .50 caliber.

The Lockheed Aircraft Corp., has purchased Union Air Terminal, Burbank, Calif., subject to approval by the Civil Aeronautics Board, from United Airlines for $1,500,000.

International Nickel Co. of Canada, Ltd., and subsidiaries, have net profit of $26,425,104 for nine months ended Sept. 30 after all charges, reserves, taxes, etc. equal after preferred dividend requirements to $1.71 each on the 14,584,025 no par common shares outstanding. Assets as of Sept. 30 were $95,055,604.

Columbia Axle Co., Cleveland has been purchased from Aviation & Transportation Corp., by Walter E. Schott and Louis Goldsmith, manufacturers. Columbia Axle is engaged in the manufacture of two-speed axles and in the machining of bombs and other defense work.

OBITUARIES

Charles L. Cameron, sales engineer of the Monarch Machine Tool Co., Newark, N. J. office, died recently of a heart attack. Mr. Cameron had been a member of the Monarch organization since 1927.

J. Philip Jayme, manager in charge of the operating department of the Crucible Steel Co. of America, died of a heart ailment at the age of 75. From 1881 until it was absorbed by the Crucible Co. in 1900, Mr. Jayme was employed by the La Belle Steel Works in Pittsburgh. He has been operating department manager of the Crucible Co. since 1921.

Seymour G. Van Arnam, 80, former sales manager of the Buffalo Pitts Co., at one time the largest manufacturer of threshing machinery in the world, died in his home recently.

Robert L. Crane, president and general manager of the Robert L. Crane Co., Buffalo, died suddenly of a heart attack two weeks ago. He was 68 years old.

Archie W. Lucas, New England sales manager for the Jessop Steel Co., Washington, Pa., died recently. Mr. Lucas had been a member of the organization since 1929.

MEETINGS

American Society of Mechanical Engineers. Annual convention. New York, N. Y., Dec. 2–5.

Motor & Equipment Manufacturers Association. Annual meeting. Blackstone Hotel, Chicago, Ill., Dec. 10.

National Exposition of Power and Mechanical Engineering. Grand Central Palace, New York, N. Y., Dec. 2–5.

Society of Automotive Engineers. Annual meeting, and engineering display. Book-Cadillac Hotel, Detroit, Mich., Jan. 6–10, 1941.

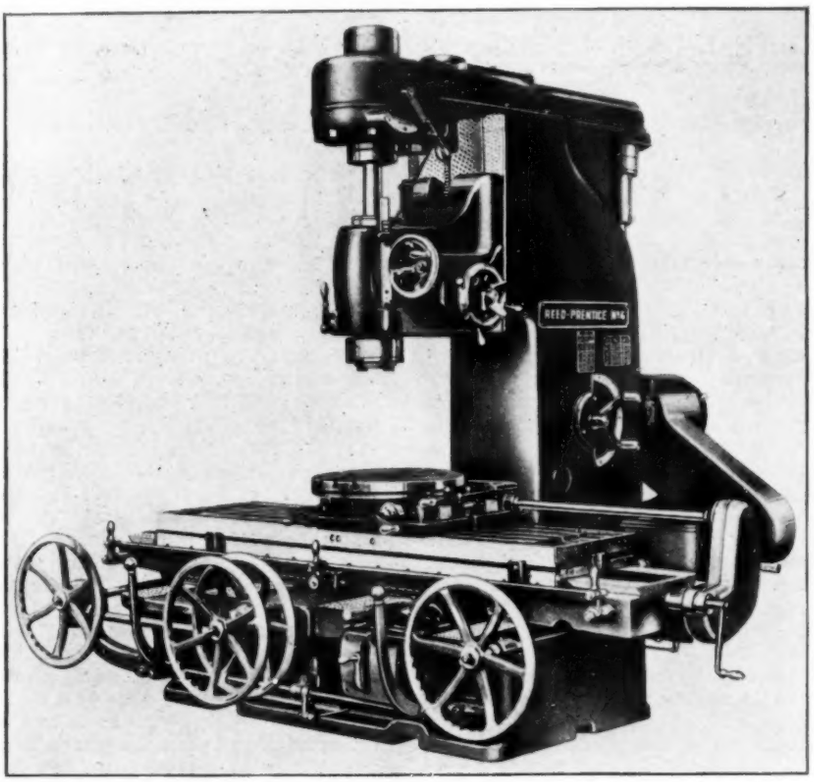
SHOP EQUIPMENT NEWS

Reed-Prentice Vertical Miller and Die Sinker Uses Totally Inclosed Gear Drive to Spindle

A totally inclosed gear drive, with all shafts running on Timken roller bearings, is used in the No. 6 vertical miller and die sinker manufactured by Reed-Prentice Corp., Worcester, Mass. Head provides double back gearing with drive to spindle at lowest point, securing maximum power and rigidity. All driving gears are of heat-treated alloy steel.

The saddle extends the full table length, forming a rigid support for the table. It has four bearing surfaces, scraped to the base. The table, which is likewise scraped to the saddle, has five T-slots serving as oil channels, and oil pockets at each end. Longitudinal and cross feed screws are of heat-treated chrome molybdenum steel, with threads milled and polished. Maximum operating efficiency is secured through a power rapid table traverse in either direction at 95 in. per min.

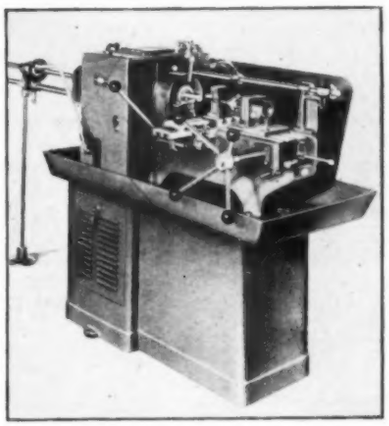
Heat-treated forged chrome vanadium steel spindle is mounted on Timken tapered roller bearings. It is provided with a 12-in. graduated scale and micrometer stop for accurately feeding to depth. Both spindle and head are provided with counterweight. Twelve spindle speeds ranging from 15 to 500 r.p.m. are available. For each spindle speed there are eight feeds.



Oster "Rapiduction" Lathe Built for Easy Operation

Designed primarily as a low cost manufacturing tool for simple turning operations, the "Rapiduction" lathe developed by Oster Mfg. Co., 2057 E. 61st Pl., Cleveland, Ohio, has a capacity of 1½-in. round for cutting-off, boring, tapping, facing, threading and other jobs. Capable of being operated by semi-skilled labor, this machine is equipped with a cross slide and saddle and is quickly and easily set up for three operations.

Spindle head is totally inclosed, carrying the spindle and worm shaft which runs in oil. Spindle runs on ball bearings and is built with American standard flanged type nose. It is driven by a hardened and ground



steel worm and bronze worm gear. Worm shaft is also mounted on ball bearings. Multiple V-belts from the motor to worm shaft is the method of drive, speed changes being obtainable through quick-change sheaves giving spindle speeds from 140 to 1000 r.p.m. A coolant pump, mounted in the base, is driven by a V-belt from the motor.

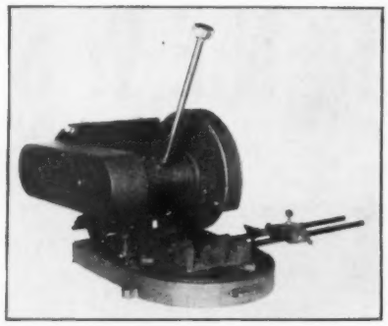
Mounted on the carriage with key and T-bolts, the toolpost is provided with longitudinal adjustment for the length of the carriage. A variety of chucking equipment is obtainable, including faceplate, automatic and universal and either manual or automatic stock stop. Power is furnished by a 2-hp. 1800/3600 r.p.m., induction motor with reverse or electric braking optional.

The machine has a swing of 13 in. over its bed and 6 in. over the cross slide. Floor space required is 33 x 70 in. without bar feed extension. If bar feed is used, it extends 94 in. beyond the pan. Net weight of the machine is 1386 lb.

Catskill Abrasive Machine Cuts Off Metals, Plastics

Hard metals, plastics and ceramics can be cut off with the Model D dry abrasive cut-off machine built by Catskill Metal Works, Inc., Catskill, N. Y. Abrasive wheel and motor are balanced on a heavy cast iron spindle frame, doing away with counterweights. Alloy steel spindle is equipped with alemite lubricated ball bearings. Spindle frame has adjustable two-way stop to regulate depth of cut.

Wheel guard is of heavy construction, bolted to spindle frame and equipped with a special panel which may be quickly removed for changing

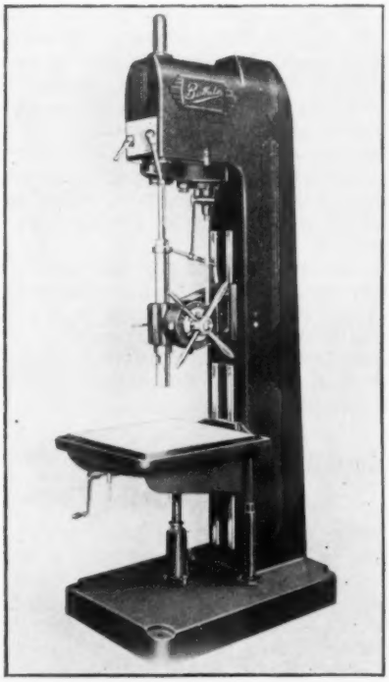


wheels. Swivel V-block vise allows cuts from 90 to 45 deg. angles. Cutting gage is adjustable from 0 to 18 in. The machine is driven by a 1½ hp. 3 phase ball bearing 3600 r.p.m. motor, driving through two V-belts. A 10-in. diameter abrasive wheel is used.

Buffalo "RPMster" Drill Has 100 Spindle Speeds

Any of 100 spindle speeds can be selected with the motor running on the "RPMster" drill press offered by Buffalo Forge Co., Buffalo, N. Y. Two sizes, with capacities of 1½ and 1 in. in cast iron, are available. Both have an overhang of 13 in.

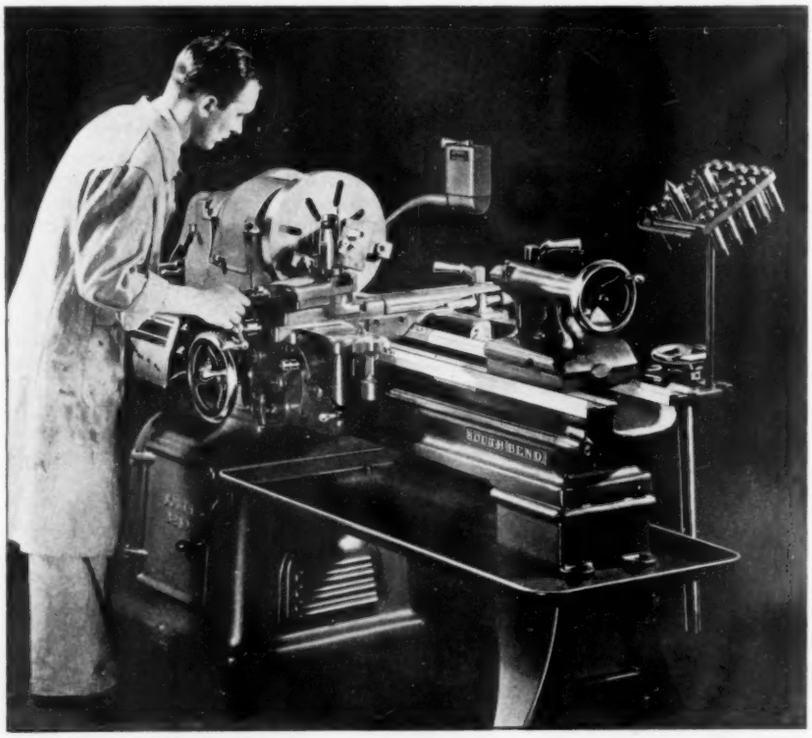
Machines can be furnished with or



without back gears and with or without power feed. All controls are within easy reach of the operator. Motor and controls are built into the pedestal. Drive is through V-belts. Space under spindle nose is 27 in. Table measures 23 x 22 in. Weight is approximately 2,300 lb.

South Bend 16-In. Toolroom Lathe Saves Time on Precision Work

The Series S toolroom lathe announced by South Bend Lathe Works, 426 E. Madison St., South Bend, Ind., is claimed to be especially adapted to fine work. A convenient control arrangement saves time and effort, reducing operator fatigue and assuring maximum production. Large handwheels facilitate precision adjustments on close work. Adjustable micrometer collars on the cross feed screw and the compound rest screw



are large with clear-cut graduations.

Toolroom attachments supplied with the lathe include handwheel type draw-in collet chuck, telescopic taper attachment, micrometer carriage stop, thread dial indicator, and chip pan. An electric grinding attachment, milling attachment and other attachments, chucks and accessories are available.

The telescopic taper attachment is permenently fixed to the lathe carriage and is always ready for use, regardless of the position of the carriage. To engage the taper attachment, it is only necessary to tighten two binding screws. The telescopic cross feed screw eliminates the necessity of disconnecting the cross feed nut when the taper attachment is to be used. The cross feed screw may be used to adjust the turning tool for the required diameter, and the taper attachment may then be engaged. To change back to straight turning, it is only necessary to loosen the two binding screws.

The fully inclosed underneath motor drive provides eight spindle speeds ranging from 21 to 725 r.p.m. Vibration-free operation at high speed is achieved by using a direct belt drive to the carefully balanced cone pulley and spindle assembly. Motor and driving mechanism are mounted in the cabinet leg under the headstock. Back gears provide slow spindle speeds and ample power for machining large diameters. A convenient belt tension release lever and wrenchless bull gear lock permit rapid changing of spindle speeds.

A quick-change gear mechanism provides 48 power longitudinal carriage feeds from 0.0015 in. to 0.0841 in., 48 power cross feeds from 0.0006 in. to 0.0312 in., and 48 right and left hand screw threads from 4 to 225 per in.

Large headstock spindle bearings provide extreme rigidity to reduce chatter. Alloy steel spindle has all bearing surfaces carburized, hardened and precision ground. Spindle journals are superfinished to a smoothness of 5 microinches. Bed is a heavy semi-steel casting with three large V-ways and one flat way. Carriage is heavily constructed, with long bearing surfaces. Apron is a double wall one-piece type, providing rigid support for both ends of all gear shafts. Power carriage feeds are operated by a worm drive and a series of steel gears in the apron which run in an oil bath. Power

feeds are controlled by a multiple-disk clutch.

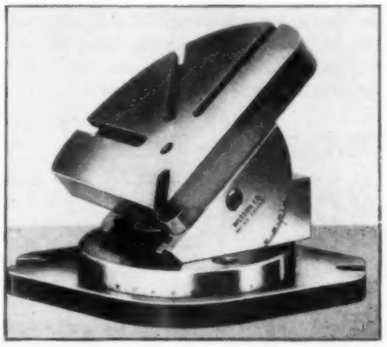
The Series S lathe has a 16-in. swing. It is made in bed lengths of 6, 7 and 8 ft., with center distances of 34, 46 and 58 in. respectively. The headstock has a 1⅝ in. capacity through the spindle, and takes collets up to 1 in. capacity.

Universal Angle Plate Fits Various Machines

The universal angle plate announced by Wesson Co., 1050 Mt. Elliott Ave., Detroit, Mich., is said greatly to increase the range of work which can be done on drill presses, grinders and milling machines. Instead of vise jaws, the universal base with patented cradle design is fitted with a slotted top plate.

The plate may be adjusted in three planes, each plane completely graduated. Through the use of this device, parts which are too large or of too irregular shape to be held conveniently in a vise can be clamped by T-slots in the top plate.

The device provides an important advantage when work involves a number of different operations using



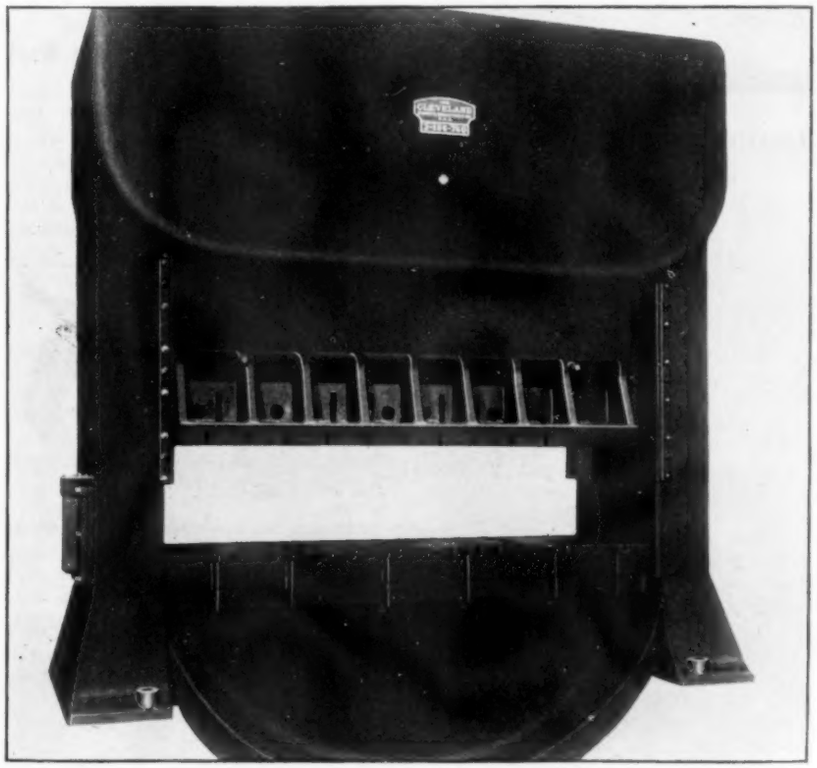
the same angle. Once the work is clamped to the angle plate and the angle established, it need not be disturbed as the entire device may be moved from one machine to another without removing the work.

Cleveland Punch & Shear Works Builds 750-Ton Two-Point Press

The 750-ton two-point press developed by Cleveland Punch & Shear Works Co., 3900 St. Clair Ave., Cleveland, Ohio, measures 156 in. between the uprights and has an over-all height of 260 in. Press is symmetrical front and back, the double gearing and the drive unit being located in the box type crown. It is equipped with a pneumatically operated friction clutch and brake, and the flywheel is provided with an air brake to bring the flywheel to a quick stop whenever the power is shut off.

The slide is counterbalanced by air, the cylinders being located in the uprights where they are readily accessible and can easily be removed without disturbing any other portion of the press. The bed, which measures 52 in. front to back and 156 in. right to left, is equipped with a T-slotted bolster plate and pneumatic cushions. Slide stroke is 12 in. Press operates at a speed of 9 strokes per min.

All gears run in oil, and there is an overflow limit in all gear housings to permit excess oil to return to the reservoir in the slide. All bearings are lubricated by an automatic power operated pump.



Carbide Tool Grinder Built for Heavy Duty

As a companion to the Model AA machine, the heavy duty carbide tool grinder offered by Thos. Prosser & Son, 120 Wall St., New York, N. Y., embodies all the features of the smaller machine, plus ample power for grinding the heaviest tools. It also incorporates provision for wet grinding.

Machine provides for rapid metal

removal when roughing, and for accurate finishing of all single point tools with flat surfaces held exactly to the desired angles. Absence of vibration makes it suited to the use of diamond wheels. At the same time, it has ample power and stamina to permit the use of the coarsest roughing wheels. High-speed steel and Stellite, as well as carbide tools, can be ground economically.

Wet grinding equipment provides a copious coolant flow, permitting faster grinding of all types of carbide tools without danger of cracking or checking, and resulting in less wheel wear. Equipment consists of a coolant pump, pan, and settling tank.

The grinder is equipped with quick-acting indexing tables, permitting instant setting to the desired

angle. It is never necessary to raise or lower the table as its edge always remains at the same point with respect to the wheel face. Spindle runs in double-row, self-aligning, precision ball bearings, with labyrinth dust seal, driven by double V-belts. The grinder uses either diamond or silicon carbide cup wheels on either end so that any combination of wheels can be employed. Cup wheels are mounted on steel backing plates, and their location on the shaft is adjustable to compensate for wheel wear. The wheel face can be kept close to the table and the wheels can be almost entirely consumed. A totally enclosed dust-proof motor is supplied, with a drum type on-off-reverse switch, so that roughing and finishing of both right and left-hand tools are convenient.

Die Finishing Equipment Makes Short Runs Feasible

Equipment for finishing and servicing Carboloy drawing dies for producing special shapes of bar and rod introduced by Carboloy Co., 11149 E. Eight Mile Road, Detroit, Mich., permits users to employ such dies economically for short as well as long runs. The company is also offering shape dies, in low-priced cored or pre-formed states, for rapid finishing to shape with the new line of equipment.

The line comprises standard hexagon and square rough cored dies available in a wide range of sizes. These dies require minimum stock removal for finishing to the usual sizes, the cored shapes being virtually identical to the usual forms of drawing dies.

Equipment consists essentially of a die-bearing sizing machine, a die shaping machine, a hand polishing tool and an adaptation of a bench shaper for machining the required laps. All three machines have the same basic action—a short high-speed reciprocating stroke. In all cases an electric motor drive actuates an eccentric which in turn imparts a reciprocating motion to the vertical spindle.

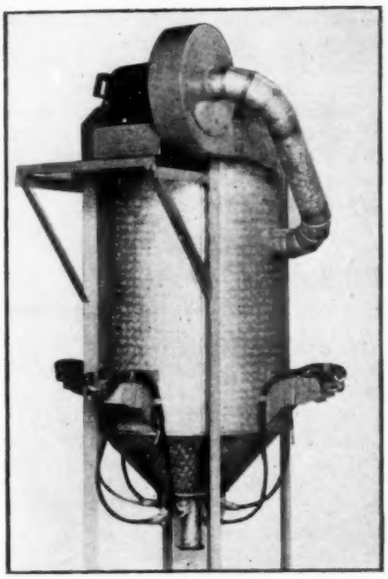
To rough and finish the bearing of the dies, laps of the same shape as the bearing, but with 0.010 in. taper, are used, the number of laps depending on the number of times 0.010 in. must be removed. Laps for producing entrance, approach, bell and back relief angles also are smaller. In lapping the angles, the lap is reciprocated by the vertical spindle. At the same time, die and spindle are rotated slowly by hand. The finishing or polishing hand tool also employs laps, reciprocated at high speed through an electric motor driven eccentric with a short stroke.

A special adaptation of an Atlas bench shaper has been worked out for machining the laps. The swivel plate on this shaper is mounted at an angle so that in the normal position a 0.010-in. taper is produced on the laps. The swivel plate is set over at a 5-deg. angle to the stroke so that feed marks will be at an angle to the lap axis, producing a filing action.

Abrasive Cleaning Machine Cleans Three Parts at Once

Three small parts at once can be cleaned or stencilled with the semi-automatic sandblast machine built by Leiman Bros., Christie St., Newark, N. J. The machine is entirely self-contained, all of the work being done under cover, without the discomfort of flying sand or dust particles.

In addition to the machine itself, there are three revolving tables—each table holding several fixtures for the parts. A motor-operated table brings one part inside the cylindrical sandblast cabinet and directly under two enclosed sandblasting nozzles. After hesitating under the nozzle, for a predetermined time, the table rotates to the next fixture. The same procedure is simultaneously taking place at the other two tables. An attendant at each revolving table removes a finished article when the table comes to a

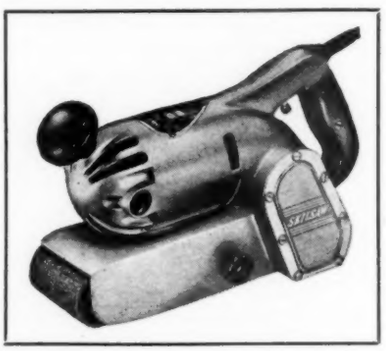


standstill and replaces it with a new article to be sandblasted.

The sandblast unit itself, with its three enclosed nozzle stations of two nozzles each, is cylindrical in shape with a strong suction motor-driven dust collecting fan and dust separator. This dust collector maintains an indrawing draft at each nozzle station, preventing any outward escape of dust. A cleanout section is provided for removing abrasives deposited in the form of dust in the separator. All nozzles are continuously fed with abrasive, which can be used over and over until entirely consumed or reduced to dust.

"Zephryplane Junior" Sander Suitable for Light Work

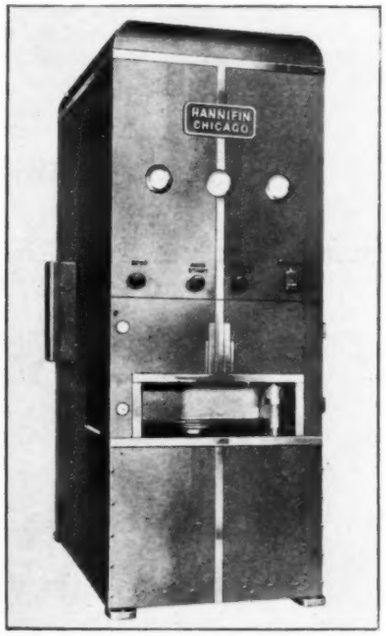
The "Zephyrplane Junior" 2¼-in. belt sander made by Skilsaw, Inc., 5033-43 Elston Ave., Chicago, Ill., is especially suitable for "clean up" work and for many final finish operations. Among its features are a die-cast aluminum frame, ball bearing



construction, and a universal motor. A patented control lever permits quick belt changes. Belt travels at 600 ft. per min., and is kept uniformly taut by a coil spring. The sander weighs only 9½ lb.

Hannifin Centrifugal Quenching Machine Saves Time and Minimizes Distortion

Designed for handling many types of circular parts, the centrifugal quenching machine developed by Hannifin Mfg. Co., 621-631 S. Kolmar Ave., Chicago, Ill., is claimed to avoid distortion and save 80 per cent of quenching time by providing accurate control of the quenching process. Coolant is applied to the entire circumference simultaneously, with progressive quenching toward the center of the piece. The machine provides correction of mechanical alignment of the parts when hot, with adjustable pressures on fixtures to give flattening and rounding effect as necessary. Closely controlled are time of quenching operation, volume of quenching medium, and temperature of quenching medium as quenching progresses.

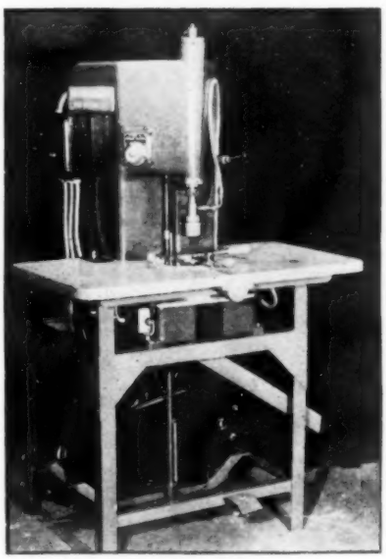


In operation, the heated part is placed on the lower fixture, after which the automatically operated holding fixtures close and provide a mechanical straightening effect or alignment of the hot part. When closed, the entire assembly of quenching chamber, holding fixture and hot part is rotated by a motor. Quenching oil is then introduced at the outer edge of the revolving container. As the oil volume is increased, quenching takes place from the circumference of the part toward the center. Oil flows out of the revolving chamber under controlled conditions, so that uniformity of temperature is maintained by fresh oil. Complete automatic cycle occupies from 40 to 60 sec. on typical gears and sprockets, as compared with 4 to 5 min. reuired by usual methods. Sectional quenching under controlled conditions is easily obtained, allowing the center of the part to remain unquenched, resulting in differential hardness of the finished piece.

Plastic Drawing Presses Made Available by Taber

Taber Instrument Co., North Tonawanda, N. Y., has announced a series of hydraulic and mechanical presses equipped with special tooling for deep drawing transparent sheet plastic such as cellulose acetate, Ethofoil, and Vinylite. Many transparent containers and other products formerly made with cemented joints can now be drawn to shape without visible seams. Objects up to 3 in. diameter can readily be made with a hand press having a 6-in. stroke with a capacity of about ½ ton, while larger articles requiring pressures of one to three tons are best produced on the hydraulic press illustrated. This press has a 10-in. stroke, a ram speed of from 30 to 60 in. per min., and is capable of a sustained production of 600 pieces per hour. Pressure is supplied by a vertical vane type pump submerged directly in an oil reservoir.

Operation of the press is as follows: Disks of the required diameter are cut with a die made of steel cutting rule. These disks are then placed, one at a time, between the electrically heated draw plates. The draw plates are clamped together either by hand clamps or automatically when the foot pedal is depressed, drawing the part which is then ejected from the machine into a chute, while the ram returns to the starting position. The unit is self-contained, having a compressor mounted in the base to supply air for ejection and other purposes.

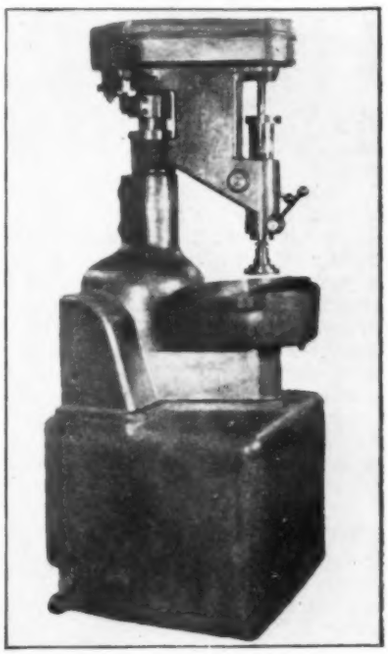


Die temperature must be held within two degrees of the ideal temperature determined for the particular operation. A dial thermometer mounted on the front of the machine indicates the temperature which is automatically controlled by thermostats in the die. A thermostat control box located just beneath the table indicates thermostat operation by a neon light.

Electrical equipment includes a magnetic starter, air compressor, oil pump, and heating equipment. A control governing press speed is mounted on the frame immediately to the left of the operator. This enables speed adjustment for the particular part to be readily made.

Flats Finished in Production With "Ultra-Lap" Machine

Any number of flat surfaces with virtually identical characteristics of flatness and smoothness can be produced on a production basis with the "Ultra-Lap" machine offered by Ultra Lap Machine Co., 246 McDougall Ave., Detroit, Mich. Due to multiplicity of motions, light pressure and type and quantity of abrasive, any material may be lapped without danger of loading abrasive into the finished surface. Limits of less than one light band (0.000012 in.) for flatness and one micro inch r.m.s. for flatness and smoothness can be met.

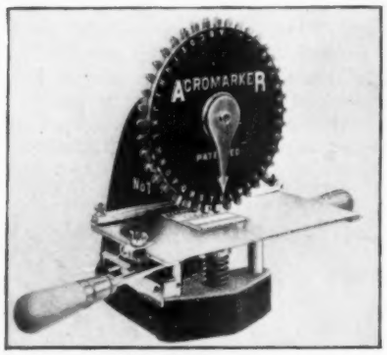


The machine is designed for easy operation, and is built to stand up under continuous operation. It mechanically reproduces the motion most used in hand lapping opera-

tions. Lapping plates stand up for an extremely large number of surfaces before they require reconditioning. It is claimed that the only time it is necessary to remachine the face of the lap is when the plates are accidentally damaged.

Versatility Features Design Of H. O. Bates "AcromarkeR"

The "AcromarkeR" name plate stamping machine offered by H. O. Bates (AcromarK Co.), 245 N. Broad St., Elizabeth, N. J., is adapted to stamping complete name plates from metal strip and to filling in serial numbers, specifications and other information into etched, embossed, cast and other types of metal, fiber or plastic plates. Holding fixture receives a plate up to 8 x 4¾ in., and permits stamping within an area of



5 in. left to right by 3¼ in. top to bottom, up to ⅝ in. thick.

Die wheel rotates on double row SKF precision roller bearings. It has a positive stop for positioning each character. Machine table can be advanced a full space or a fraction of space. Powerful screw pressure permits stamping of steel, stainless steel and alloy steels. Dies are of heavy-duty construction, and are designed to withstand severe service. Machine is finished in black and chromium.

"Pix-Up" Finder and Tray Speeds Up Screw Driving

An increase of from three to nine times in the speed of power-driving screws is claimed for the Thor "Pix-Up" finder and "Adjusto-Tray" developed by Independent Pneumatic Tool Co., 610 W. Jackson Blvd., Chicago, Ill. This device, which sorts, picks up and holds screws for driving, eliminates time wasting hand operations of picking up screws by the fingers and starting or holding the screw in a tapped or drilled hole. Not magnetic, but entirely mechanical, the unit is simple in design and operation.

The unit consists of the "Adjusto-Tray", which is spring mounted on a base and adjustable by clamp screws for the length of screw to be driven. Into this tray, which has a series of slots, screws are spilled; shaking the tray a few times suspends the screws in the slots by their heads. A power screw driver equipped with the "Pix-Up" finder is then placed over a screw head and pressed. As the tray depresses slightly, the

finder grips the screw head firmly, holding it ready for driving. Finder itself is an extension type that can be fitted to any Thor power screw driver. It has three slots lengthwise which open slightly as the finder is pressed over the screw head and close on the head to hold it, acting as mechanical fingers. Inside the lower end, the finder is recessed to fit the particular screw to be driven.

Bore Inspection Telescope Penetrates up to 20 Ft.

A clear and detailed view, much enlarged, of the inner walls of gun barrels, tubing, pipes, boiler tubes, and similar members up to a depth of 20½ ft. is provided with the Model No. M 2125 bore inspection telescope developed by Gaertner Scientific Corp., 1201 Wrightwood Ave., Chicago, Ill. Small holes, cracks, pits, scratches and other defects are readily seen. Inspection can be made in tubes 1 to 4 in. in diameter.

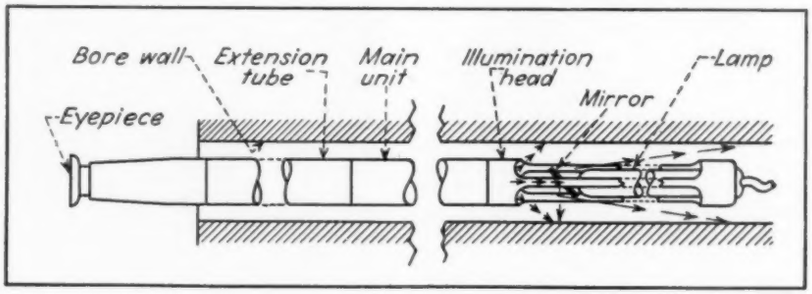
The main unit of the telescope permits inspection of tubing to a depth of 4½ ft. It consists of an illuminating head, a telescope tube containing the necessary optics, and a removable eye-piece. Extension tubes, each 4 ft. long and containing the necessary optics, can be added to the main unit to increase the depth of inspection. As many as four of these extension tubes can be added, giving a maximum usable depth of 20½ ft. The method of connecting the extensions is such as to ensure a rigid tube.

The illuminating head which carries a special tubular lamp, is provided with an adjustable inclined mirror, which enables the observer not only to look along the inner walls of the bore, but also to obtain a direct view at right angles to the wall. The image of the wall formed by the mirror appears in the center of the field of view. The view is such as would be seen were it possible to place the eye within 2 to 8 in. of the point being inspected.

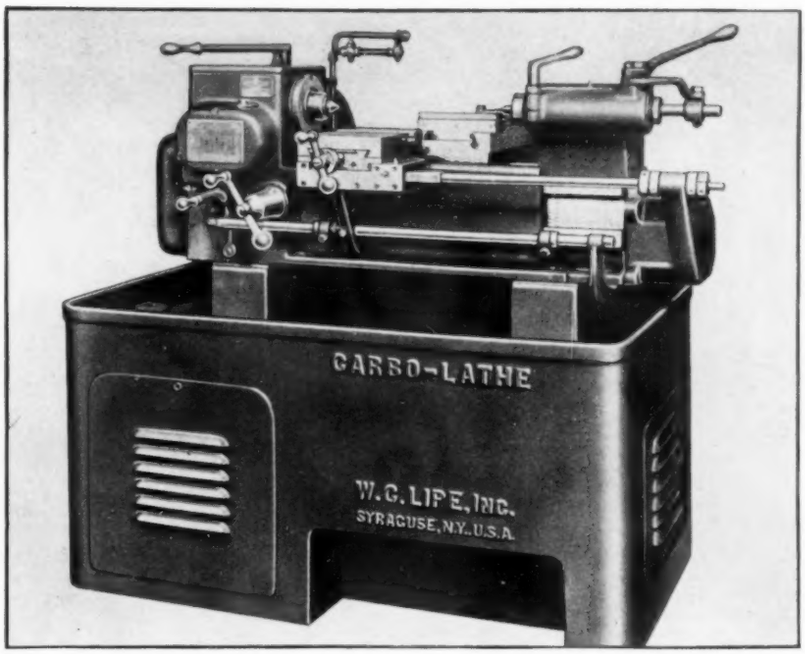
Half-Ton Lift Truck Used Without Skids

The ½-ton ball bearing lift truck offered by Barrett-Cravens Co., 3255 W. 30th St., Chicago, Ill., can be used either with or without skids

because of a sheet metal deck on the upper frame. Made in platform heights of 3½, 6, 7 and 9 in., this small truck is available only in 18 in. widths, with lifts of 2 in.



Improvements in Lipe "Carbo-Lathe" Give Extra Rigidity for Heavy Work



Designed for high-production turning with modern alloy tools, the "Carbo-Lathe" made by W. C. Lipe, Inc., 208 S. Geddes St., Syracuse, N. Y., incorporates improvements that add to rigidity and increase the machine's ability to take heavy cuts in tough materials at high speed without chatter or tool breakage.

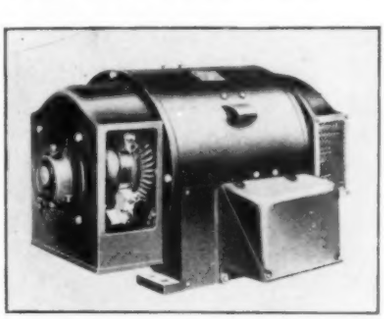
Base is a box section completely inclosing the motor and drive mechanism. All controls are out of sight. The motor cabinet is considerably larger to accommodate a motor as large as 10 hp., and to provide space for free air circulation and efficient motor ventilation. The base also houses a coolant tank now double in capacity, and a large chip pan. Recessed toe room is of sufficient height to prevent interference even when the operator stands on a platform. A compartment at the end of the base gives room for storing tools and accessories. Box-type construction requires no additional floor area.

Size of the lathe permits 12 in. swing and 18 in. between centers. Power is applied through worm drive. Reduction of friction is obtained by mounting the spindle on two Timken bearings and by using ball bearings on the clutch pulley, clutch shaft, worm shaft, feed worm-gear shaft, clutch-feed shaft, hand-feed shaft, rack pinions and feed shaft in bed.

The 600-lb. headstock and bed are cast in one solid piece of chrome-nickel iron. A correspondingly heavy two-piece tailstock is used. Tailstock quill is 3 in. in diameter. Its center can be operated by handwheel or lever, supplied optionally.

General Electric d.c. Motors Are Safer, More Compact

Compactness and improved protection are two outstanding features of a line of d.c. motors announced by General Electric Co., Schenectady, N. Y. A new design of rolled-steel frame and improvements in end-shield and bearing-bracket construction combine to give these motors better protection from external damage. Use of "Formex" wire coils and a specially developed insulating varnish provides high resistance to impact, abrasion, and action of foreign materials. Motors can be furnished with either sleeve or ball bearings.



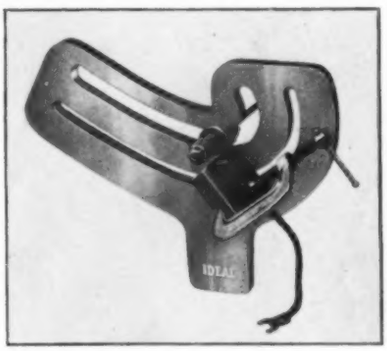
Open motors are available in constant-speed ratings from ½ hp. at 850 r.p.m. up to 60 hp. at 1,750 r.p.m., and in adjustable-speed ratings from ½ hp. at 850/3,400 r.p.m. up to 15 hp. at 500/1,800 r.p.m. Motors in the larger ratings (beginning at 50 hp., 850 r.p.m.) embody additional design innovations such as a new system of self-ventilation, extra protection of all current-carrying and rotating parts, and large conduit boxes. V-type double brush-holders give better commutation and permit rotation in either direction. A new type lifting lug facilitates handling.

Other features common to the entire line include lower WR^2, small diameter, and reversal without changing any parts of the frame, fan, or brush rigging.

"Ideal" Brush Concaver Produces Accurate Shape

It's easy to form brushes to the commutator curvature with the carbon brush concaver announced by Ideal Commutator Dresser Co., 1057 Park Ave., Sycamore, Ill. With this device the old brush is used as a templet to locate the arc segment on the cutting guide slot, which corresponds to the contour of the commutator or slip ring. After this segment is found the new brushes may be formed without further set-up.

Any electric drill or electrical shaft drive may be used to operate the cutting head. The complete unit includes aluminum guide casting, cutting file, removable angle plate with clamping device and C-clamp. The device takes practically any size brush for a 4 to 48-in. diameter commutator.



Midget Toggle Plier Devised for Aircraft Work

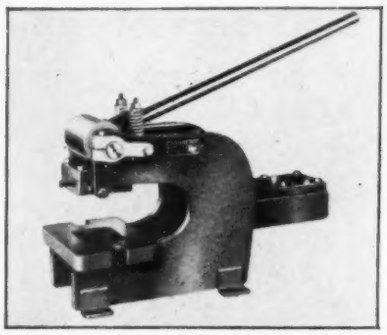
Knu-Vise, Inc., 16841 Hamilton Ave., Detroit, Mich., has developed a midget toggle plier especially for use in the aircraft industry. Over-all length of this tool is only 3 in., and

weight is only 3 oz. Made from SAE 1029 steel, hardened and tempered, it provides a leverage of more than 90:1, thus enabling the operator to grip small parts with a pressure in excess of that obtained with the small conventional C-clamp.

Leslie Hand Punch Press Maintains Positive Alignment

The hand-operated punch press built by Leslie Welding Co., 2943 Carroll Ave., Chicago, Ill., is claimed to incorporate the accuracy of a leader pin die set, although it has no ram, ways nor slides. Register of punches and dies is maintained by a leaf arm which is rigid except at its flexing point. Because of this construction, coupled with an unduly wide bearing of the operating eccentric, it is said to be unnecessary to center the load on the punch plate.

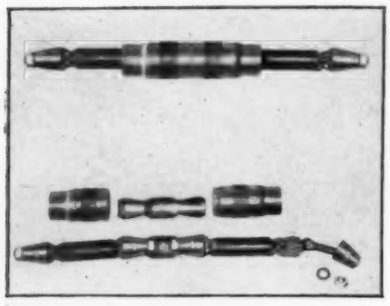
The press is especially adapted to blanking and punching small stampings and punching along the edges of



large sheets. Punch plate measures 4 x 4¼ in. and is designed to accommodate most blanking punches ordinarily used on small power presses. Clearance from punch plate center to frame is 6 in. Stroke is $\frac{7}{16}$ in., with a stroke adjustment of ⅛ in. Press has a capacity for punching through 14 gage mild steel or 16 gage 18–8 stainless steel.

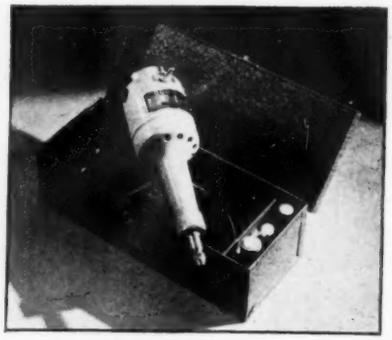
Welding Cable Connectors Lock Conductors Together

Joints in arc welding cables are securely locked together with the insulated cable connectors offered by Jackson Electrode Holder Co., 6553 Woodward Ave., Detroit, Mich. The



device provides a positive and quick method of connecting various lengths of arc welding cable.

To apply, about 1½ in. of insulation is stripped from the end of the cable. The fine wires are spread enough to insert the coned head of the connector bolt and a copper sleeve and lock washer slipped on. The nut is screwed down as tight as possible to clamp the cable strands against the inside wall of the sleeve and provide copper-to-copper conductivity. The same process is repeated with the other cable end, both sleeves are placed in the copper shells, and the insulated housings are slipped on and screwed together. A red insulator housing identifies the positive connector; black, negative.

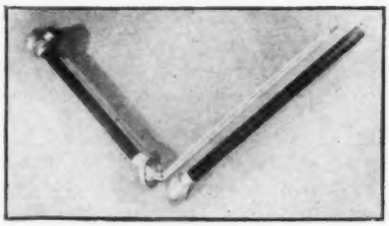


Steel Carrying Case Protects Hand Grinders

To keep its No. 8 and 10 hand grinders free from shop dirt and to prevent them from being misplaced, Dumore Co., Racine, Wis., has developed a sturdy steel carrying case. This case measures 11x4¼x3¼ in. and also contains a compartment for storing extra grinding wheels, abrasive bands and arbors.

L&N Thermocouple Fitting Makes Replacement Easier

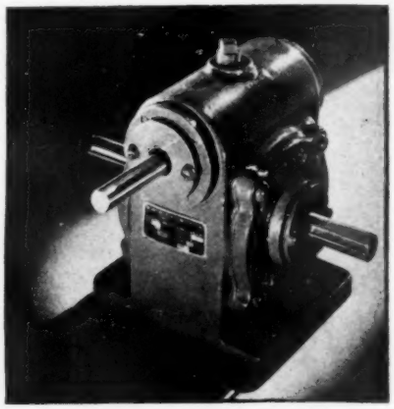
To facilitate thermocouple replacement, a universal union for angle-type couples has been adopted by Leeds & Northrup Co., 4934 Stenton



Ave., Philadelphia, Pa. The two halves of this union fit snugly together in a ground joint making it vapor- and fume-tight. By unscrewing a single clamping nut the thermocouple's hot leg can be detached; or it can be rotated to any angle between 90 and 180 deg. and locked firmly in place.

Worm Gear Speed Reducer Transmits Light Loads

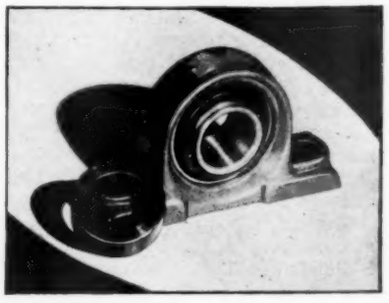
The No. 3½ BT worm gear speed reducer has been designed by Winfield H. Smith, Inc., Springville, N. Y., for efficient speed reduction in frac-



tional horsepower applications. Said to be of high quality construction throughout, this worm-on-top reducer embodies a worm of hardened steel with ground threads keyed to the shaft which is mounted on radial thrust type ball bearings. Gears are of special alloy bearing bronze. Built-in oil seals are provided at all shaft extensions. Ratios of 58, 36, 18 and 9 to 1 are available, in the ¼-hp. rating with a torque capacity up to 190 in.-lb. Unit measures 6½ in. high, 4⅛ in. wide and 5 in. long. Weight is about 16 lb.

"Mechani-Seal" Ball Bearings Used in Transmission Units

Fafnir Bearing Co., New Britain, Conn., has developed a series of pillow blocks and other transmission



units incorporating "Mechani-Seal" ball bearings. The light series pillow blocks, flange cartridges and cylindrical cartridges offer two outstanding advantages, for in addition to the efficiency of the seal construction, they offer the ease of application made possible by a wide inner ring design with self-locking collar. They are locked to the shaft with a finger-twist. No machining, adapters or lock nuts are required.

The "Mechani-Seal" bearing, em-

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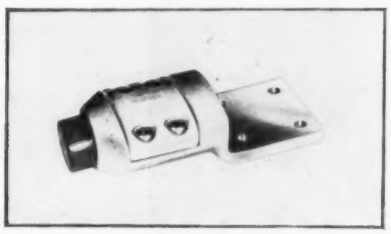
ploying close tolerances rather than rubbing material for its efficiency, imposes no extra friction or drag. Two steel plate shields form the innermost members. They are tightly fitted to the bearing outer ring. An outer corrosion-proofed steel plate shield, pressed on the inner ring, clears these inner plates by definite but close tolerances, and acts as an efficient slinger.

"Sealmaster" Ball Bearings Have Extended Inner Rings

Extended inner rings are provided in the Style A "Sealmaster" ball bearing units developed by Stephens-Adamson Mfg. Co., Aurora, Ill. For machine application on straight shafts, these bearings employ a centrifugal labyrinth seal, eliminating the necessity for seals in the housing. Annular grease groove with two holes permits regreasing. Bearing is fitted with a snap ring to permit through bore of the housing. It is available for shaft sizes from ⅝ to 2 1/16 in.



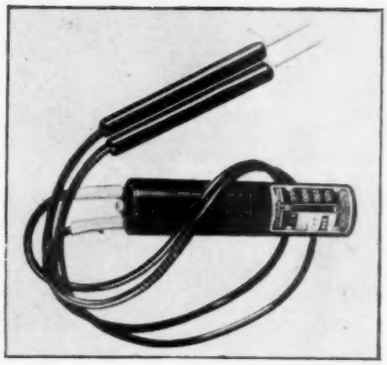
"Streamlined" Terminal Designed for Easy Taping

Type SNA-H "Streamlined" cable terminal offered by Burndy Engineering Co., 459 E. 133rd St., New York, N. Y., has been designed to facilitate easy taping of the connector and to help insure a moisture-proof seal to the insulation. A recess at the cable entrance permits the end of the cable insulation to be inserted into the connector, thus shrouding and protecting the insulation. This connector is also made with hexagon head cap screws set in recesses in the cap in such a way that they can be easily tightened with an ordinary socket wrench.

Square D Voltage Tester Permits Easier Readings

Use of different colored bands for each alternating current voltage, together with increased pointer travel at higher voltages, makes possible easier readings with the No. 5000 voltage tester offered by Square D Co., Detroit, Mich. In this improved instrument alternating current is distinguished from direct current by vibration of the pointer, which is flush with the outside of the case to prevent injury. Operating mechanism has been strengthened and improved to provide greater accuracy.

Long, rubber-covered lead wires are fitted with hooks and with sharp points for piercing wire insulation without damage. Steel strands in the wires make the leads capable of resisting considerable strain without breaking. Fiber handles insulate the leads, which are armored at the entrance to the case to prevent wear or breakage.



Kux-Lohner Hand Ladling Die Caster Molds Parts from Aluminum or Brass

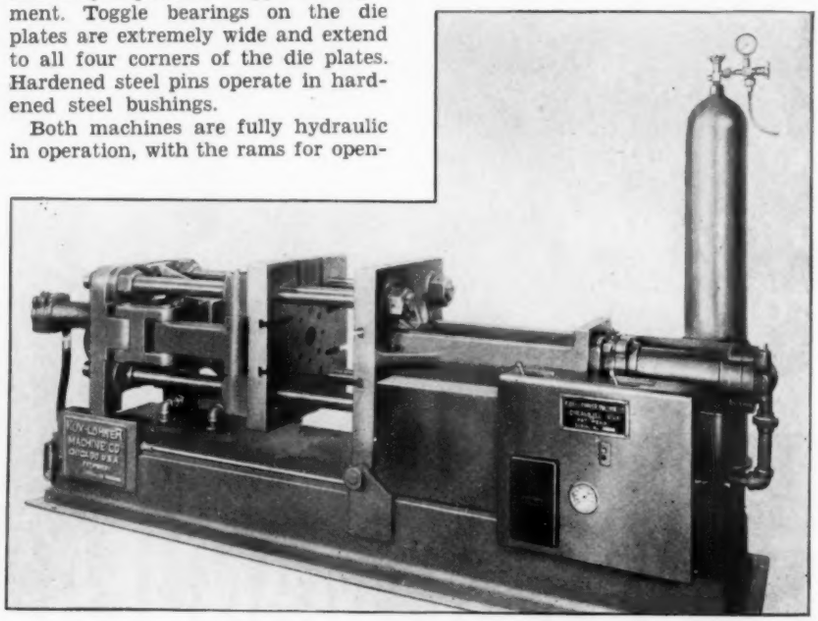
Die castings of either aluminum or brass alloys can be produced with the high-pressure type die-casting machines developed by Kux-Lohner Machine Co., 2145-47 Lexington St., Chicago, Ill. Built in two sizes, these machines are of the hand-ladling type in which the molten metal is poured from a crucible into a well at the back of the stationary die half, and from there injected into the die under pressure up to 10,000 lb. per sq. in.

On the Model HP-12 machine, die space between bars is 12 in. square. On the No. HP-18 model, die space is 18 in. square. Castings weighing up to 7 lb. in brass and 2½ lb. in aluminum can be made.

Machines are massively built to withstand both high injection and die locking pressures. All parts subjected to wear are made of heat-treated alloy steels. Dies are opened and closed by a powerful toggle arrangement. Toggle bearings on the die plates are extremely wide and extend to all four corners of the die plates. Hardened steel pins operate in hardened steel bushings.

Both machines are fully hydraulic in operation, with the rams for opening and closing the dies and injecting the metal all operated from a central motor driven hydraulic pump mounted on an oil storage tank. Only one operator is required. Machines are built close to the floor to facilitate ladling. The ladling well is approximately table height, with no interfering members around it.

Incorporated in these machines are safety features whereby each phase of the casting cycle must be operated in the proper sequence and each cycle completed before the next one can start. An electric timing device controls the solidifying period. Operation of two hand levers, one controlling the die opening and closing, the second controlling the injection plunger, puts the machine through its complete cycle. A gas accumulator bottle charged with nitrogen is provided to intensify speed of the shot.



Non-Slip Floor Wax Makes Use of Neoprene

Flexrock Co., Dept. AM, 2300 Manning St., Philadelphia, Pa., has developed a non-slip floor wax embodying du Pont Neoprene. Use of this synthetic rubber is claimed to provide longer life and greater resistance to abrasion and heat.

General Electric Galvanometer Provides Extreme Sensitivity

A galvanometer more than three times as sensitive as previous ones has been introduced by General Electric Co., Schenectady, N. Y. This instrument is said to be suitable for many applications where wall types were heretofore frequently necessary. Applications include temporary setups for factory and laboratory testing and permanent installations for testing instruments, material, and production apparatus where rapid readings and minimum operator fatigue are essential. Extreme sensitivity is obtained by two fixed mirrors inside the case, which increase the effective light beam length.

Galvanometer element and optical systems are mounted in sturdy cast aluminum alloy case. Translucent scale is double-marked 50–0–50 and 0–100 in 1-mm. divisions. Light is provided by an easily replaceable automobile-type lamp, which provides a high-intensity spot with hairline index, so that the scale can be read quickly, accurately, and with minimum fatigue. An external adjuster is provided for setting the element.

"Colorflex" Floor Dye Made Fire, Acid and Alkali Resistant

"Colorflex", an enamel-like floor dye, offered by Flexrock Co., 2300 Manning St., Philadelphia, Pa., has been improved to make it resistant to fire, acids and alkali. It is claimed that a match can be applied to the surface without the gloss being injured. It is likewise claimed that the surface is unaffected by either concentrated or dilute sulphuric or carbolic acids.

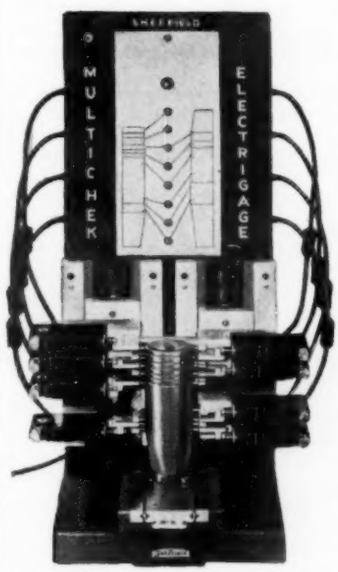
"Vanite" Polishing Grain Made Under Rigid Control

An advantage of "Vanite," a fused aluminum oxide polish grain developed by Hanson-Van Winkle-Munning Co., Matawan, N. J., is the rigid manufacturing control to produce consistent uniformity from keg to keg and from month to month as regards size, shape and chemical composition of the grain. The grain is a product of Bauxite, from which all impurities such as a titanium oxide, iron oxide, silicate, etc., have been removed.

Grains are of the "blocky" type, as nearly equi-dimensional as possible and practically free from weak par-

They SHALL NOT PASS

Unless every one of the eight critical dimensions of this 75 mm. shell checks within prescribed limits, it does not pass this guardian of quality. Six hundred an hour of these shell bodies are thus checked on the Sheffield Multichek Electrigage pictured at the left. In a flash the inspector knows whether each shell body is acceptable or not.



The slightest variation beyond tolerance limits is flashed by a colored signal light on the control board above the Electrigage head. The color of the light indicates whether the dimension is oversize or undersize. And the position of the colored flash indicates just which dimension or dimensions are incorrect. If all dimensions are correct the master signal at the top of the board so indicates. Then it is unnecessary to read individual signals.

If your problem is rapid, accurate inspection of multiple dimensions on a wide variety of parts without eye strain, write for particulars on the Sheffield Multichek Electrigage.

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ticles which have inferior abrasive value. Its high capillarity makes the compound especially suitable for use with adhesives. It is said to make possible the production of a strong wheel head which will give maximum polishing performance and economy.

M.S.A. "Comfo" Respirator Protects Against Metal Fumes

For protection against fumes of metals, such as those generated when burning, pouring or molding lead, cadmium, zinc, etc., the "Comfo" respirator has been developed by Mine Safety Appliances Co., Braddock, Thomas & Meade Sts., Pittsburgh, Pa. Approved by the U. S. Bureau of Mines, this unit provides complete working freedom and permits use of goggles or other headgear without interference.

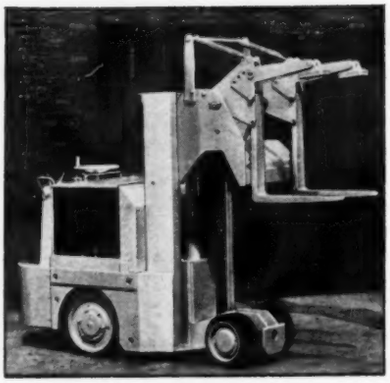
Construction features include filters of unique design, having high filtering efficiency against fine metal

fumes; filter area more than double that of regular dust filters; aluminum filter containers, assuring long filter life by keeping out grease and dirt; all-rubber facepiece which fits any face snugly and comfortably; and foolproof U. S. Army type exhalation valve.

Mercury Ford Truck Handles Sheet Metal

Mercury Mfg. Co., 4118 S. Halsted St., Chicago, Ill., has devised a fork truck with automatic clamps for handling tin plate and loose stacks of sheet metal. Designated as the Model A-2440, this truck is a two-wheel drive, four-wheel steer machine with horizontal steering wheel.

The truck, having a capacity of 4,000 lb., loads up to 36 in. in length. It is driven through a heavy duty double reduction axle. Travel controller is of the double unit mechanical contactor type, providing four



speeds in both directions and having separate handles for travel direction and speed selection.

Hoist mechanism is the conventional Mercury hydraulic type. Fork lift and over-all height are subject to variation to meet specific requirements.

Chattering Eliminated by Barber-Colman "Motorelay"

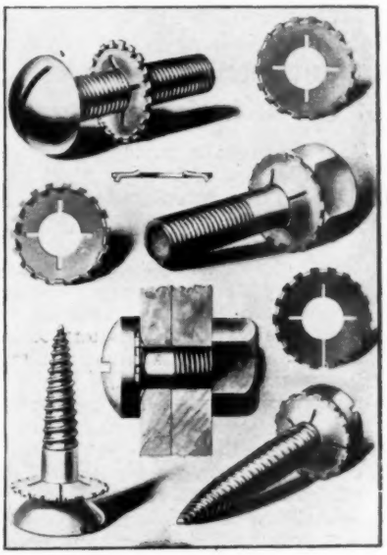
Consisting of a small reversible geared-head "Barcol" motor which tilts two mercury tubes, the "Motorelay" offered by Barber-Colman Co., Rockford, Ill., permits throttling, floating, or proportioning control of a 5-amp. load from a sensitive instrument having a current rating as low as 0.35 amp. Chattering is eliminated because a momentary contact at the instrument is not sufficient to close the mercury tube switch.

Tubes are arranged to give single pole, double throw operation, with spring return to a neutral "off" posi-

tion. The switch is particularly suited to floating or proportioning control of line voltage motors operating large dampers, valves, speed adjusters, voltage regulators and similar equipment.

"Pre-Fixed" Lock Washer Assembled With Press

The "Pre-Fixed" lock washer designed by Mechanical Laboratories, Inc., 128-130 Latham St., Pittsburgh, Pa., is assembled to a standard threaded fastener before leaving the factory by a simple press operation, without the necessity of any special operations in the manufacture of screw or washer. Washer itself resembles a standard lock washer, with radial slots extending outward from the central hole. This hole is slightly smaller than the screw thread diam-



eter. Dimensions are such that the washer is assembled merely by pressing it over the thread.

"Kollag" Graphite Lubricant Permits Use of Cheaper Oils

It is claimed that less viscous and generally cheaper oils can be used satisfactorily in combination with "Kollag" graphite lubricant offered by Pfaltz & Bauer, Inc., Empire State Bldg., New York, N. Y. This colloidal graphite, suspended in a specially selected type of lubricating oil, is said to have a purity of 99.8 per cent. It is intended to effect oil economy, save power, reduce friction and minimize wear.

Goodrich V-Belt Prevents Static Electricity Accumulation

What is believed to be the first V-belt ever made which prevents accumulation of static electricity and retains its static-discharging qualities throughout its entire service life has been announced by B. F. Goodrich Co., Akron, Ohio. This V-belt will be sold, for the present, only to machine and equipment makers. This improvement is expected to be of great importance in machinery design for applications where a static discharge might create a fire hazard.

Another important feature of the belt is the absence of any danger of the belt acting as a short between the motor and its operator. Resistance built into the belt is just enough so that the belt itself cannot act as a direct conductor of current.

Four Lighting Fixtures Announced by Wiremold

The Wiremold Co., Hartford, Conn., has made available a line of wired and unwired fluorescent units, and two new complete related "Plugmold" multiple outlet systems. The fluorescent units are available in unit lengths for any specified size and number of lamps, with or without reflectors of either concentrating or diffusing types. Special controls designed to fit within the channel make a completely self-contained installation.

The smaller No. 1900 "Plugmold" mutiple outlet system has a capacity of two wires for single circuits. The large No. 2100 system has a capacity of 6 wires, for switch-controlled circuits and where fluorescent lighting is combined with outlet installations.

Line of Machinists' Tools Introduced by George Scherr

George Scherr Co., 128 Lafayette St., New York, N. Y., has brought out its own line of "GS" machinists' tools. The line consists of a combination set with drop forged hardened square heads, hardened center head, hardened blade and reversible protractor head; a combination set with hardened blade and center head, protractor and square head of cast iron: 4, 6 and 8 in. dividers; 4, 6 and 8 in. inside and outside spring calipers; hardened and tempered center gages; thickness gages; depth gages; surface gages and magnifiers. Hook, sliding caliper, flexible and narrow tempered rules are also included in this line.

"Glasflex" Floor Finish Resists Fire, Acid, Alkali

Flexrock Co., Dept. AM, 2300 Manning St., Philadelphia, Pa. has improved its "Glasflex" transparent floor covering so that it is claimed to be totally resistant to acid and alkali. It is said that this material can be submerged in concentrated sulphuric acid, dilute sulphuric acid, carbolic acid, sodium hydroxide solution, soaked in alcohol and ignited without the gloss being affected.

"Paratex" Floor Coating Has Chlorinated Rubber Base

Many disadvantages of linseed oil base floor coverings are claimed to be eliminated in the "Paratex" coating for concrete and wood floors developed by Truscon Laboratories, Box 69, Milwaukee Junction P. O., Detroit, Mich. This paint is said to flow easily and brush out smoothly, so that the average painter can apply it readily.

When drying conditions are good, "Paratex" will dry hard enough to walk on in a few hours. It will be oil and grease-proof in 24 hours, and resistant to most chemicals in 48 hours. It is claimed to be unaffected by sunlight. Six colors are available.

Correction—Fell Level

The "All-Way" precision level introduced by William B. Fell Co., 700 South St., Rockford, Ill., (*AM*—Vol. 84, page 897) while easily read to 0.00025 in., also shows 0.005 in. per ft., instead of only 0.0005 in. per ft., as previously stated.

NEW MATERIALS

Laminated Shim Stock Marked for Convenience

Thin shim stock supplied in slotted cartons by Laminated Shim Co., Glenbrook, Conn., now is furnished plainly marked in inches on its edge. Markings run from 0 to 100 in., with half-inch subdivisions throughout the 100 in. length. Thus the metal can be conveniently pulled through the carton slot and cut off to exact size. Not only is waste avoided but the markings also indicate when the roll is almost used up. These packaged rolls of 6-in. wide brass or steel shim stock are available in thicknesses of 0.001 to 0.015 in.

Wear-Resistant Steel Can Be Easily Welded

A tough, austenetic non-magnetic steel alloy which combines abrasion-resistant properties with weldability without subsequent heat-treatment has been made available by Jos. T. Ryerson & Son, Inc., 16th & Rockwell Sts., Chicago, Ill. Known as "Manganal," this alloy contains from 11 to 13½ per cent manganese and 3½ per cent nickel—the nickel content permitting the material to be welded without a subsequent quenching, as there is no loss in toughness when cooled from welding temperatures. This is said to make a reasonable structural material of a composition that would otherwise be difficult to handle. Welding rods are 18-8 stainless composition have been found to give very satisfactory results with "Manganal."

The alloy is claimed to have all the advantages of 11-14 per cent manganese in resistance to wear and work hardening. Thicknesses up to ½ in. can be sheared. Plates can be flame-cut, requiring no subsequent treatment when formed or punched hot. Physical properties include a tensile strength of 140,000-150,000 lb. per sq. in.; elastic limit of 55,000–60,000 lb. per sq. in., elongation in 2 in. of 72½ per cent; and a reduction of area of 54 per cent.

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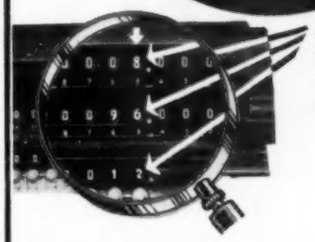

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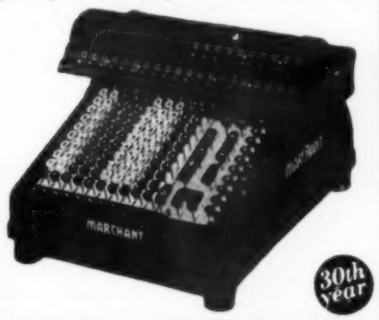

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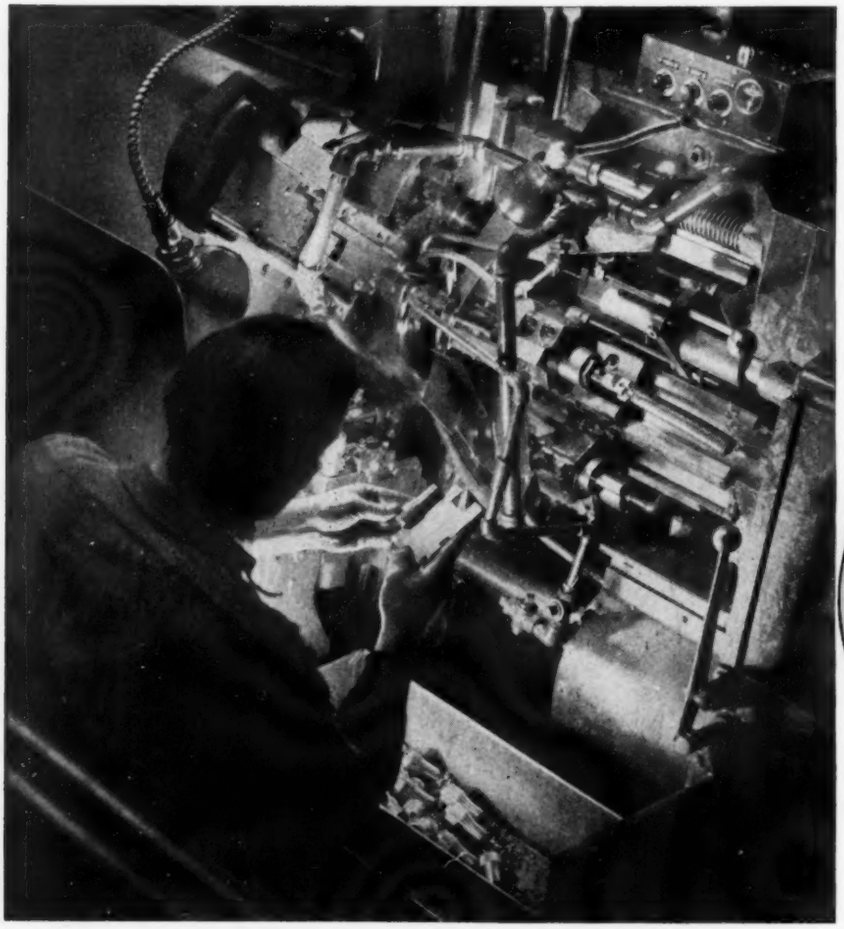

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